Economic Benefits of Mt. Cook National Park

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Abstract

Market and non-market valued decisions are associated with New Zealand's system of national parks. The use benefits of Mount Cook National Park are not priced by the market mechanism, whereas many of the inputs necessary to operate and maintain the Park are priced. Estimates of the economic benefits are relevant information when deciding upon the allocation of resources to, and within, a system of national parks.

In 1984, the consumers' surplus for adult New Zealand visitors was about $2.2 million. An estimate of the net national benefits is given by the consumers' surplus obtained by New Zealand visitors, plus the net benefits associated with foreign visitors, less the cost of Park management and land rental. The net benefit of Mount Cook National Park, as it was in 1984, is likely to be positive, indicating that the benefits associated with the current use pattern of resources exceeds their opportunity cost to the nation. However, this result cannot be used to establish the optimality of current expenditure and management.

Approximately 170 000 adults visited Mount Cook National Park over 1984; 29% were from New Zealand, 25% were from Australia, 18% were from the United States, and 7% were from Japan. Visitors to the Park spend money in towns and villages in the Mackenzie Basin area. Average adult visitor expenditure in the Mackenzie Basin area is $58. These expenditures give rise to secondary economic benefits and create opportunities for regional development. Visitor expenditures in the Mackenzie Basin area are associated with $13.4 million of additional regional output, $6.8 million of additional regional income, and 196 jobs. These effects derive their significance from regional objectives; they are not indicators of the national benefits associated with Mount Cook National Park.

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Janet Gough
Geoff Kerr
Basil Sharp

1. Introduction

Undeveloped land was a relatively abundant natural resource during the early settlement of New Zealand. Government policy and the market process served to facilitate the transformation of this natural resource into goods and services of higher value. Land was cleared for agriculture; minerals were mined; and trees were harvested. Outputs from these processes provided the raw materials necessary for economic growth, international trade, and improved standards of living.

Initially, economists did not recognise the services associated with land in its natural state, commonly assuming the opportunity cost of undeveloped land to be at most, zero. Perhaps this reflected a broader view held by society that there was an abundant supply of aesthetically pleasing landscapes, opportunities for scientific discovery, and recreational opportunities. However, diminished areas of land in its natural state, increased population, higher incomes, and education, have reversed the earlier forces at work. Land in its natural state is now recognised to have considerable value to present and future generations. Currently, protected natural areas account for about 17 percent of New Zealand's land area (Roche, 1984). National parks occupy 2.17 million hectares, about 8 percent of total land area (N.Z. House of Representatives, 1983).

Since the 1940s economists, particularly resource economists, have been developing and applying economic models which seek to estimate the economic benefits of non-market valued goods and services. National parks throughout the world have been studied and estimates of economic value have been determined. This report describes the application of a number of empirical models to data obtained from a comprehensive survey of visitors to Mount Cook National Park, and it provides estimates of economic benefits associated with the Park. Before proceeding in detail with the study, a very brief overview of the setting of Mount Cook National Park is provided.

1.1 Mount Cook National Park

1.1.1 Legislation

National parks are defined by the National Parks Act 1980 as:

> "areas of New Zealand that contain scenery of such distinctive quality, ecological systems or natural features so beautiful, unique, or scientifically important that their preservation is in the national interest." (S 4(1))

Two principles are laid down for the administration of these areas. First, parks are to be preserved:

> "in perpetuity as national parks, for their intrinsic worth and for the benefit, use and enjoyment of the public", and
>
> "they shall be preserved as far as possible in their natural state." (S 4(1), 2(a))

Second, provided conditions necessary for preservation are satisfied:

> "the public shall have freedom of entry and access to the parks." (S 4(2(e)))

The intention of the legislation is that policies should be directed to ensuring an appropriate balance between preservation and provision for public access to and enjoyment of areas that lend themselves to recreational use (National Parks and Reserves Authority, 1983). The Act also provides a basis for the administration of national parks.

Early in the history of European settlement in Canterbury, the Mount Cook region was recognised as an area of outstanding alpine scenery, and an area with interesting plants and animals (Mount Cook National Park Board, 1981). By 1887 almost two-thirds of the present park had been reserved for recreation purposes. In 1953, the various reserves were declared a national park. Today, the National Parks and Reserves Authority is responsible for general policy formulation, approving management plans and advising the Minister of Lands and the Director-General on matters of policy. Management plans for Mount Cook National Park are prepared by the Aorangi Parks and Reserves Board.

1.1.2 Physical Features

Mount Cook National Park lies east of the main divide and stretches 65 km along the crest of the Southern Alps from Butler Range to Ben Ohau Range. The Park has an area of 69 957 ha. Figure 1.1 shows the location of the Park.

Mount Cook stands at 3 764 m and there are 21 other peaks in the Park higher than 3 050 m (10 000 feet). The Park is encircled by mountain ranges and criss-crossed by deeply incised valleys, many of which are occupied by glaciers. The five major glaciers in the Park are the Murchison, Mueller, Godley, Hooker and Tasman glaciers. The largest glacier - Tasman - is 29 km in length.

Climatic conditions are quite variable, with areas experiencing extreme wind turbulence and extremes in temperature. About 30 percent of the Park is covered by permanent snow and ice. Alpine vegetation predominates and there is a diversity of bird life. Although there is much plant and animal life of unique interest, the magnificent alpine scenery is a prime feature of the Park.

State Highway 80 provides the only available road access. A daily scheduled coach service is available from Timaru, Christchurch and Queenstown. A daily air service is available from Auckland/Rotorua, Queenstown and Christchurch. Charter flights and tour coaches frequently travel to the Park.

Major facilities in the Park are located in Mount Cook Village. Figure 1.2 shows the location of the village in relation to other features of the Park.

Hotel accommodation has been a feature of this area since the earliest days of tourism, when the original Hermitage was built in 1884. Today, the Tourist Hotel Corporation (THC) provides accommodation at the third Hermitage, Glencoe Lodge, motels and chalets. There is a Youth Hostel. The majority of huts in the Park are for use by mountaineering parties. Basic camping facilities are available.

Park Headquarters is located on the Hermitage promontory. It provides general information services and interpretation programmes for visitors. A general store, alpine shop, garage, souvenir shop, coffee shop, public bar, Post Office and school complete the list of facilities. The Ministry of Works operates a depot for the maintenance of roads. The Department of Lands and Survey provides fire, ambulance and rubbish disposal services.

1.1.3 Recreation Opportunities

The mountains and glaciers of the Mount Cook region provide the Park with its distinctive and attractive features, but at the same time the alpine terrain places inherent limitations on public use. Principle activities in the Park are: sightseeing, walking, mountaineering and skiing.

Sightseeing

Three forms of sightseeing prevail: aerial, road and walking. Mount Cook Line operates scenic flights by ski plane. These flights leave from Mount cook airport, they are of varying duration and may include a ski-landing. In addition to the scenic flights operated by Mount Cook Line, Air Safaris Ltd, based at Lake Tekapo, also operates scenic flights over the Park. These flights do not land in the Park.

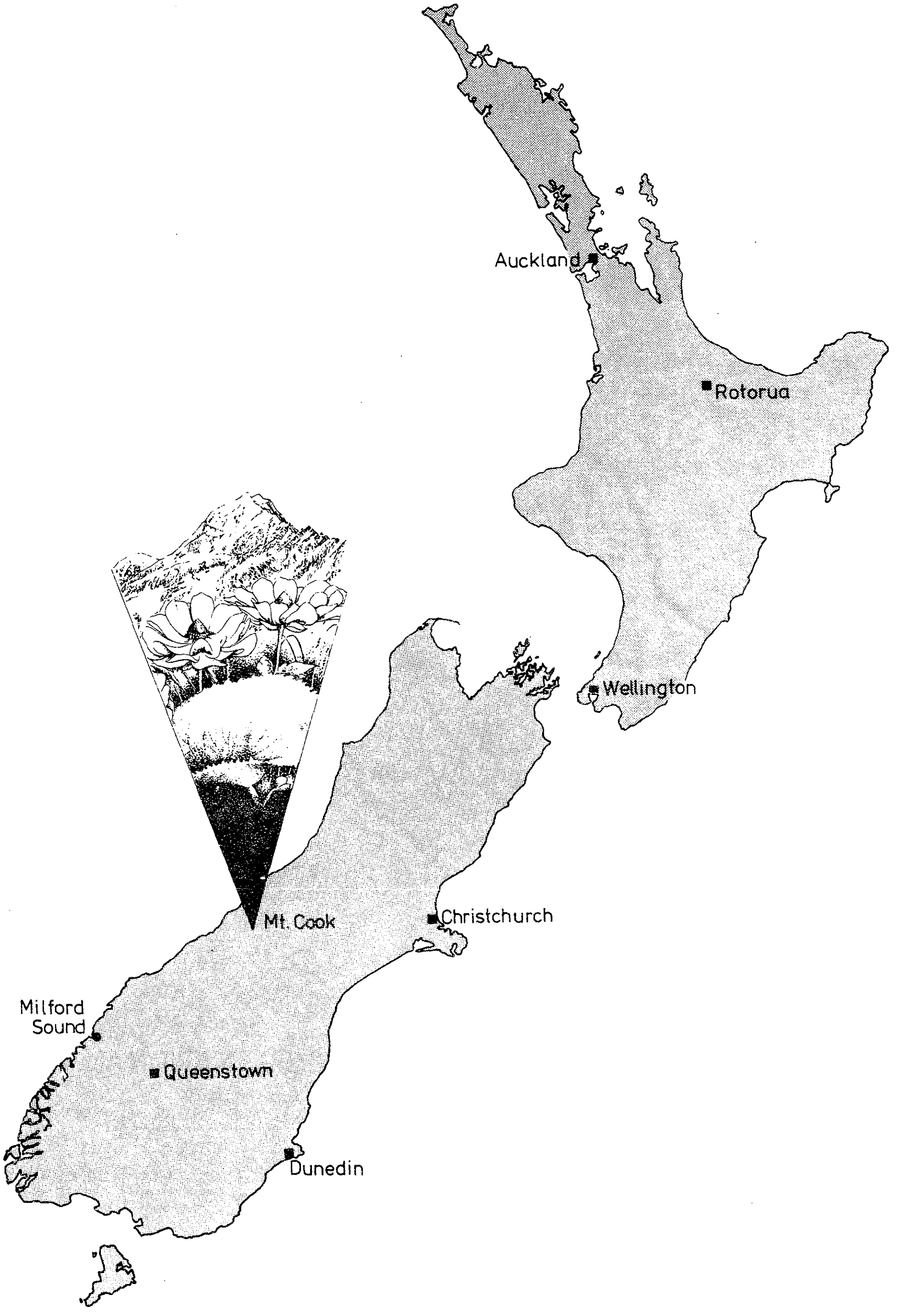


Figure 1.1: Location of Mount Cook National Park

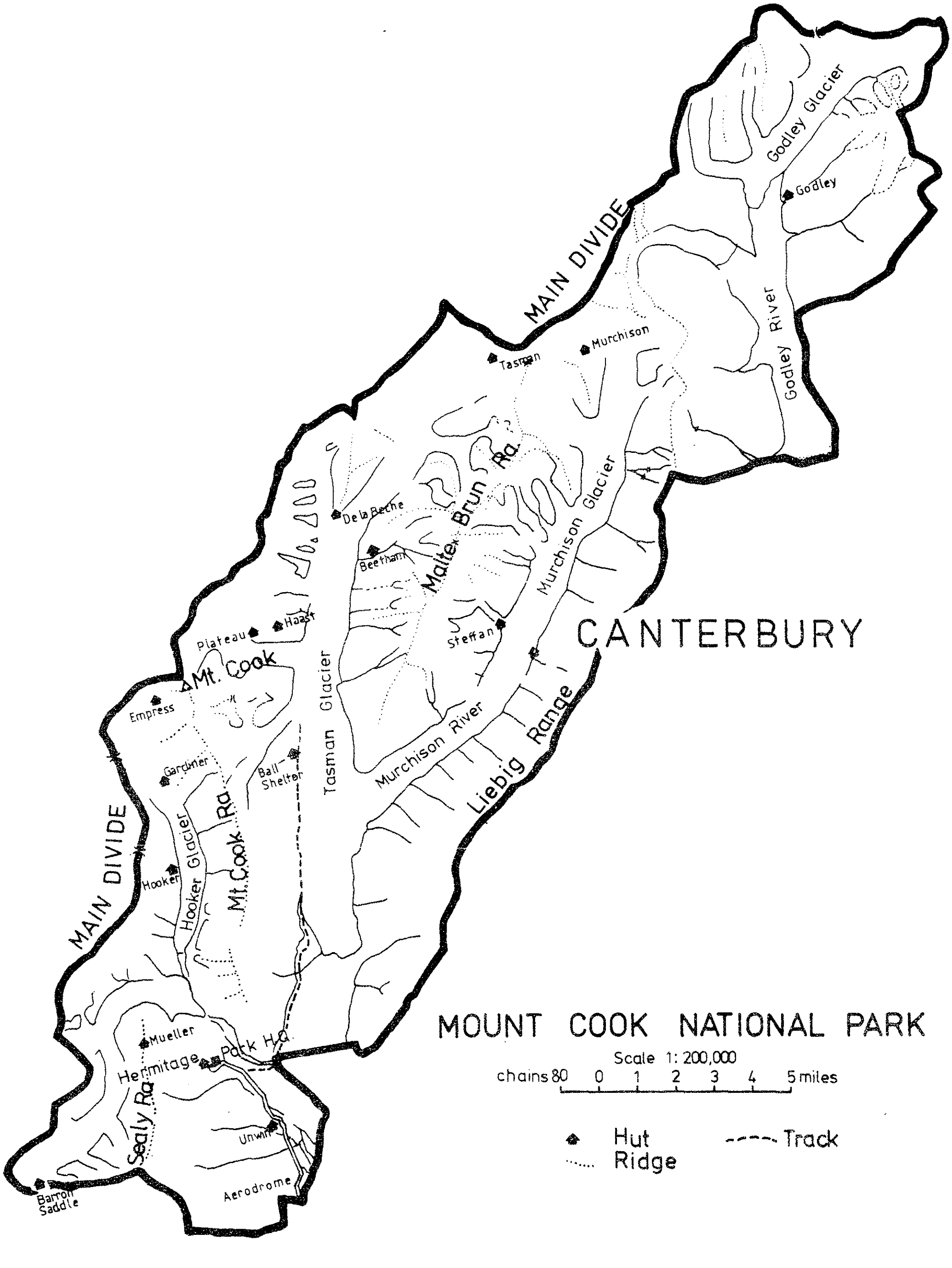


Figure 1.2: Mount Cook National Park

The greatest number of passengers is usually carried between November and January. Figure 1.3 illustrates the seasonal variation in ski-plane flights.

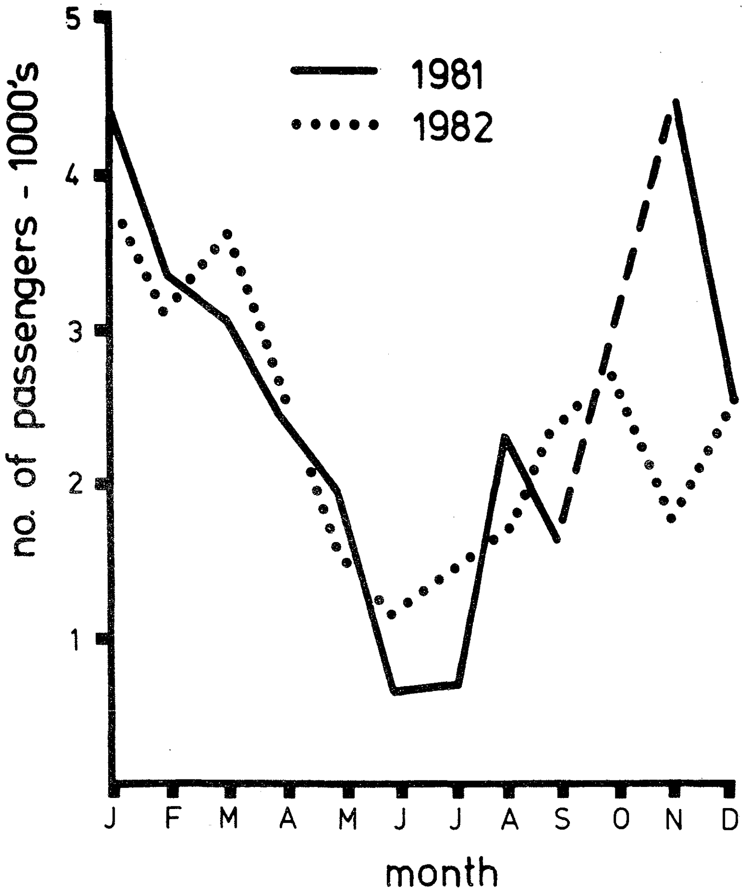


Figure 1.3: Ski-plane flights.

The approach to the Park along State Highway 80 provides the visitor with an opportunity to view high mountains and contrasts of rock and ice. With the Park visitors may drive or take a guided coach tour, up the side of the Tasman Glacier.

Visitors use the easy walks and the track system which radiates from Mount Cook Village to gain closer views of alpine scenery. Nature tours and the Park's nature interpretation programme, both of which are increasing in popularity, use many of these easy walks

Mountaineering

Mount Cook National Park is the major climbing region in New Zealand and is known internationally. Over 1 500 parties register climbing intentions at Park Headquarters each year. The number of hut bed nights gives a good indication of the number of people using the Park for mountaineering purposes. Figure 1.4 illustrates the seasonal variation in hut usage. Huts are used most in summer, especially in January and February. Winter use is low.

Skiing

Opportunities for ski-touring and ski-mountaineering exist within the Park. The season usually extends from July to October. Ski-planes give access to more remote areas for ski-mountaineering. Glacier skiing has increased in popularity. About 1 200 people skied the Tasman Glacier during the 1982/3 season. This number does not reflect total demand since numbers are limited by considerations such as availability of aircraft and weather conditions.

Hunting

There are 10 species of introduced mammals wild in the Park, and some of them - deer, chamois, thar, and hares - have had a detrimental effect on the vegetation, especially in alpine and sub-alpine zones. It is a policy of the Mount Cook National Park Management Plan to co-operate with agencies responsible for wild animal control and to permit recreational hunting of introduced animals. About 150 - 200 permits are issued each year to private hunters.

Camping

Informal camping and bivouacking may be undertaken in the Park, except where specifically forbidden. White Horse Hill has basic camping facilities 1.5 km from the village.

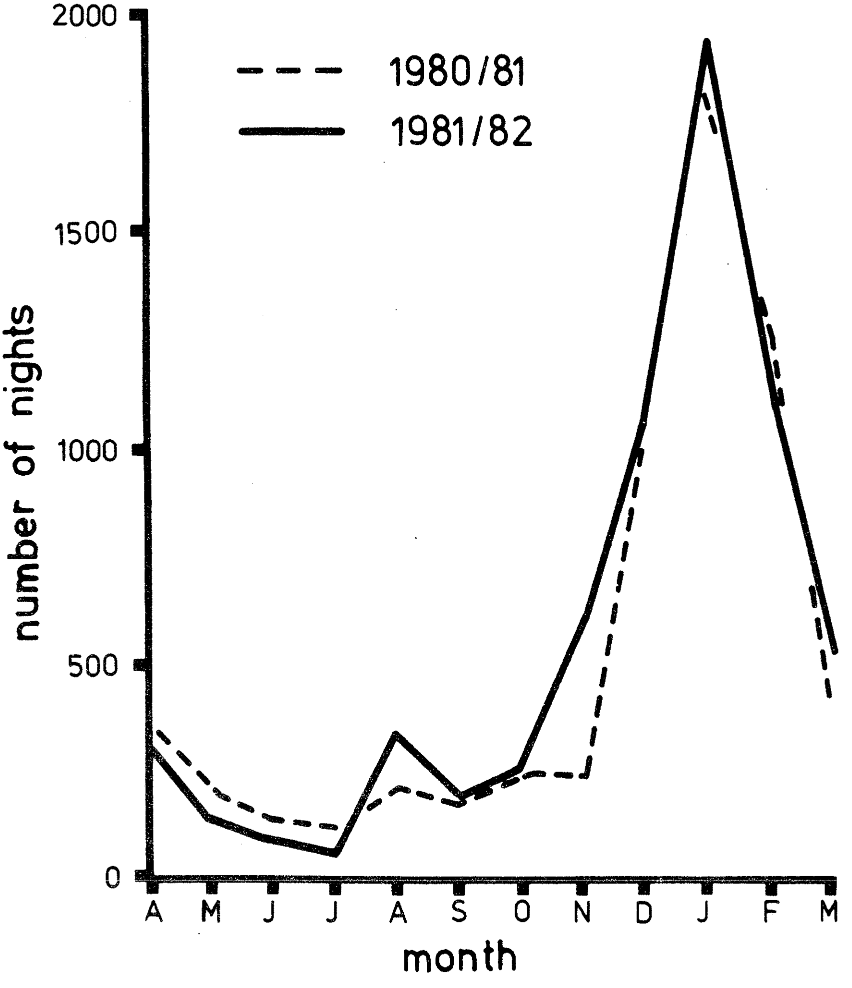


Figure 1.4: Hut bed nights

1.1.4 Visitors to the Park

Park records for the 10-year period from 1963-73 (Slater, *pers.comm.*) show an increase in the number of visitors from 45 000 to 168 000. The total number of visitors for the year 1982-3 was about 250 000. A breakdown of total visitation into season and visitor origin follows.

Seasonality

Until recently there have been very few winter visitors to Mount Cook National Park. Since the launching of the Mount Cook Ski Region promotion, winter usage has increased. Monthly visitor numbers to Park Headquarters provide some indication of seasonal variation. Figure 1.5 shows January to be the peak month for visitors to Park Headquarters.

Increased visitation during the winter months is also evident.

Visitor Origin

The majority of visitors are Australians and New Zealanders. Over the years there has been an increase in visitors from the United States of America, Canada, United Kingdom and Europe. More recently there has been a marked increase in the number of visitors from Japan and Taiwan. Entries in the "visitors' book" at Park Headquarters for the years 1978/9 and 1982/3 are summarised in Figure 1.6.

Unfortunately some nationalities sign the visitors' book more readily than others and Figure 1.6 should be interpreted with caution. For example, it is a common belief that about 50 percent of all visitors to Park Headquarters are New Zealanders (Slater, *pers.comm.*).

Visitor Activities

The principal recreation activities were described earlier. Estimates of visitor participation in these activitis prior to 1984 are listed in Table 1.1.

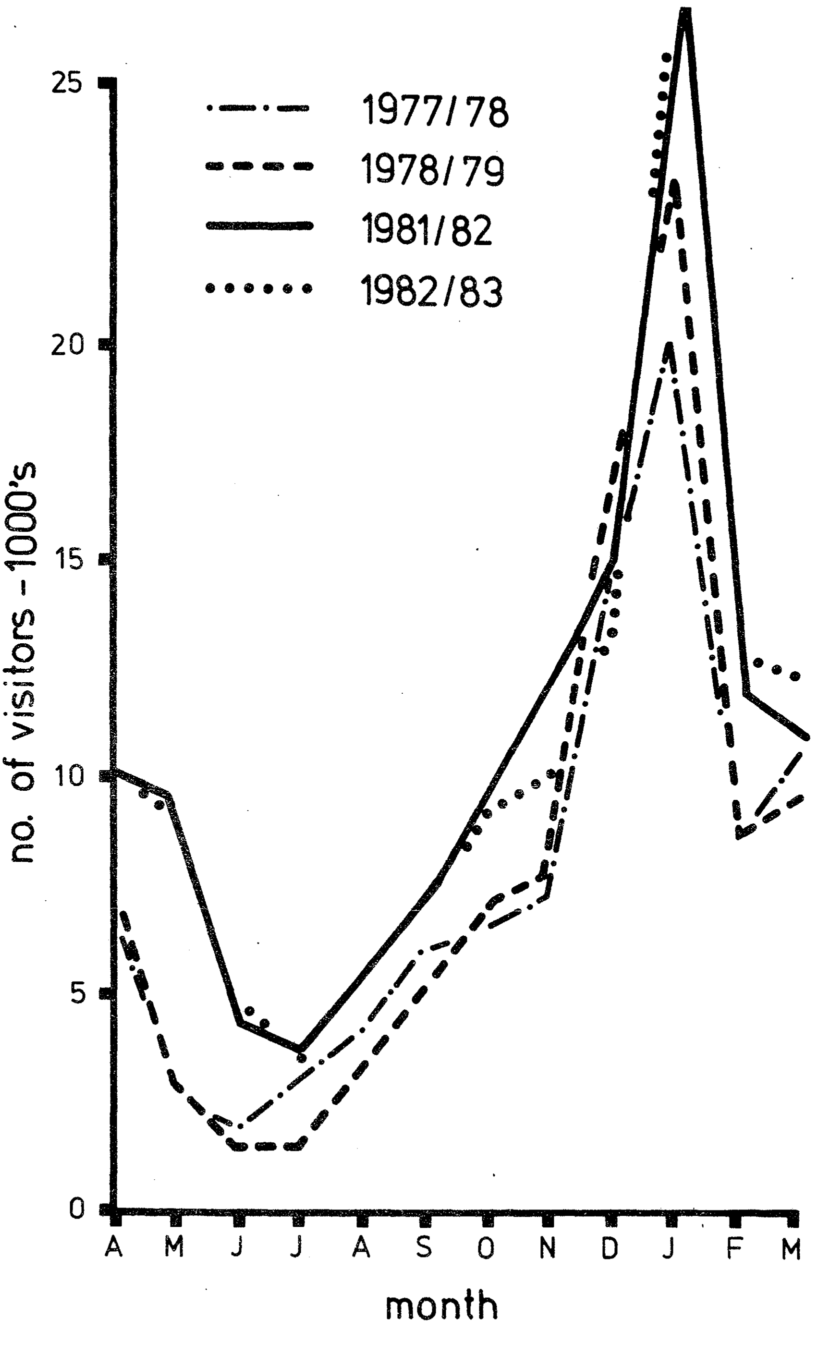


Figure 1.5: Visitors to Park Headquarters

Activity	Estimate of Annual Numbers	Year of Estimate	Period of Peak Activity
Sightseeing:			
aerial[1]	39 975	1982/3	-
road[2]	3 566	1982/3	-
walking	high level	-	-
Mountaineering:			
hut bed nights	7 407	1982/3	summer
recorded ascents[3]	153	1981/2	summer
Tasman day skiing	1 336	1982	winter
Hunting permits	148	1981/2	-

[1]Includes flights from Lake Tekapo

[2]Passengers on bus service to Tasman Glacier only

[3]Recorded ascents of major peaks (parties)

Table 1.1: Estimates of visitor participation in recreation activities

1.2 The Economic Problem

We have presented a brief overview of Mount Cook National Park, including a description of its legal and institutional setting, the current set of recreational opportunities and the origin of visitors. The supplies of services directly associated with the Park have developed within a non-market institutional framework. The recent growth of commercial activities such as glacier skiing and guided climbing within the Park does not alter this observation because the management authority is responsible for establishing the rules that govern commercial activity. Establishing a commercial enterprise in the Park is a carefully controlled privilege which is considered necessary and appropriate for public use and enjoyment (Mount Cook National Park Board, 1981).

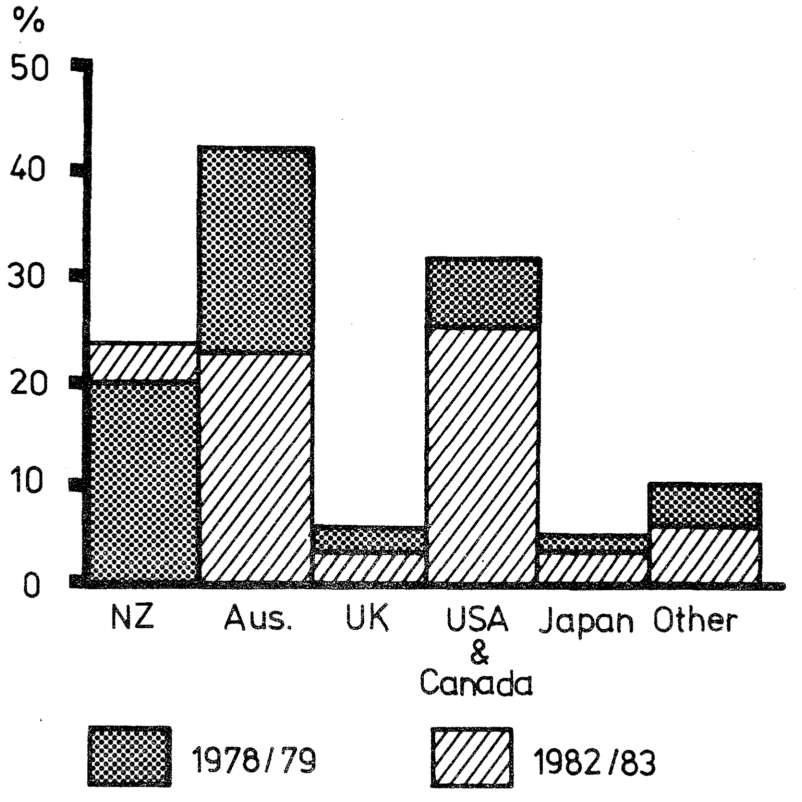


Figure 1.6: Origin of visitors to Park Headquarters

The flow of services associated with and provided by national parks are not costless to society. Supply and maintenance is supported by public funding, principally through taxation, and the cost of supply may include:

▲ the opportunity cost of acquiring physical resources;
and

▲ annual operating costs.

For a given park the total annual cost of supply would be equal to the annual return which these resources would have earned in their next best alternative, plus the costs of maintenance, upkeep, information programmes and so on.

Visitors to Mount Cook National Park expect to derive satisfaction from their visit. Visitors may derive satisfaction from climbing a mountain, walking, skiing a glacier, or just simply being there. In reality, visitors derive benefit from a bundle of interrelated services. A tramper will probably use the facilities at Park Headquarters, tracks and huts within the Park, in addition to "using" the natural environment.

In a market economy the market process serves as an information medium in transmitting to producers the qualitative and quantitative desires of consumers. These desires influence in turn, the variety and amount of goods and services produced. Where public expenditures produce things having value, money measures of values are used to express social values of the end-products of expenditure. In the case of a national park, primary benefits of an expenditure are given by the beneficiaries' willingness to pay. Total benefits are therefore measured by the aggregate willingness to pay. Data on visitation rates and visitor activities do not yield information on visitor preferences. Without information on consumer willingness-to-pay there can be no benefit analysis of public expenditures on Mount Cook National Park.

1.3 Study Objectives

The aim of this research is to estimate the economic benefits associated with Mount Cook National Park. Economic benefits may be measured in a number of ways. This study attempts to measure the use-value of Mount Cook National Park as it existed during 1984, given the existing set of visitors' preferences and opportunities.

The effects of tourism may be estimated for the region. Visitors to Mount Cook National Park pass through a number of communities within the Mackenzie Basin. Visitor expenditures help sustain the regional economy, generating income and jobs. Information on visitor expenditures and associated income and employment multipliers assists with community development and regional planning. The impact of national park management on regional economies is a further dimension of park management.

This study has three objectives:

▲ To estimate expenditure within the Mackenzie Basin by visitors to Mount Cook National Park.

■ To derive economic and labour related multipliers for the regional economy.

● To estimate the use-value ascribed to Mount Cook National Park through the "Travel Cost Model".

Estimates of (▲) and (●) are based on data obtained over the 1984 calendar year.

Trampers pause for a break in the Hooker Valley under the shadow of Mt. Cook.

1.4 Report Outline

There are three major sections in the report. First, we discuss the concept of value as used in economics. This is followed by a description of the two methods (input-out and travel cost) used to estimate economic benefits. Second, we identify particular problems associated with obtaining data at Mount Cook. Questionnaire design and the sampling procedure is described. Finally, we present estimates of regional and national benefits associated with visitors to the Park. The report concludes with a discussion on how this information might be used by national park administrators.

2. Economic Benefit

Natural resource allocation decisions usually involve both market and non-market valued services. Non-market valued services are those for which no charge is made, such as a scenic landscape or the provision of radio broadcasts. Prices in our economic system derive from markets and we rely on this institutional mechanism to provide the relative values that guide resource allocation and the distribution of goods and services. One of the tasks facing the economist is to determine if a proposal will make people better off. This task is made somewhat easier with the existence of market prices which can be used as operational indicators of consumer welfare. However, a particular problem arises in the case of national parks because the price signals that we rely on to guide resource allocation do not accompany use. Estimates of non-market values are therefore relevant when deciding upon the allocation of resources to, and within, our system of national parks.

In this chapter we are only concerned with national economic benefits. We describe the basic concepts behind market benefits first. A brief discussion of some of the reasons behind market failure leads us into a consideration of non-market benefits. We identify some of the reasons why national parks are provided by non-market institutional arrangements. Then we describe the various components of value and identify the values being estimated by this research. Finally, we provide an economic basis for the approach used.

2.1 Market Benefits

One objective of economic analysis is to determine if the introduction of a specific policy or project will make society better or worse off than a set of alternative proposals. To accomplish this objective a procedure is required that allows economists to work with data on consumer preferences. This problem of identifying operational indicators of consumer welfare has confronted economists for over 100 years. Three problems exist:

- how to determine individual preferences;
- how to add up these preferences; and
- how to compare aggregates.

The applied economist cannot directly observe consumer preferences under the different conditions implied by policy. However, in the case of market goods and services price is observable and is a measure of the value derived from consuming a commodity. Consider an individual confronted with a number of alternatives which are mutually exclusive. If the individual behaves rationally, the net gain in satisfaction associated with each alternative is considered, and the alternative yielding the largest net gain is chosen. Trade-offs, or opportunity costs, are the very essence of this process. What must be foregone in order to achieve the desired results? The individual compares losses and gains in subjective terms. This we cannot observe. However, we can observe money prices which reflect the trade-offs available. Price is an indicator of the relative importance to individuals of additional quantities of a good when compared with additional quantities of other goods and services.

In economics, it is usually assumed that society's well-being is made up only of the well-being of those individuals comprising that society (Mishan, 1969). Market economies are characterised by voluntary exchange among individuals and firms. Each participant in the market evaluates the opportunity costs associated with a potential exchange. Money functions as the common unit of account. Each buyer and seller need only focus on money price. The market trade-off (relative prices) provides a basis with which the consumer can compare his or her subjective trade-offs.

A demand curve shows the relationship between the prices of a good and the total quantity demanded by a buyer at each price during a given period. market demand is the horizontal sum of these individual demand curves. It shows what consumers are willing and able to pay for given quantities of the commodity. Figure 2.1 shows a demand schedule for commodity Q. If the price of Q is $\$P_a$, then consumers will buy up to Q_1 units. The added satisfaction obtained from consuming the Q_1th unit is given by $\$P_a$. Marginal willingness to pay usually declines as more Q is consumed.

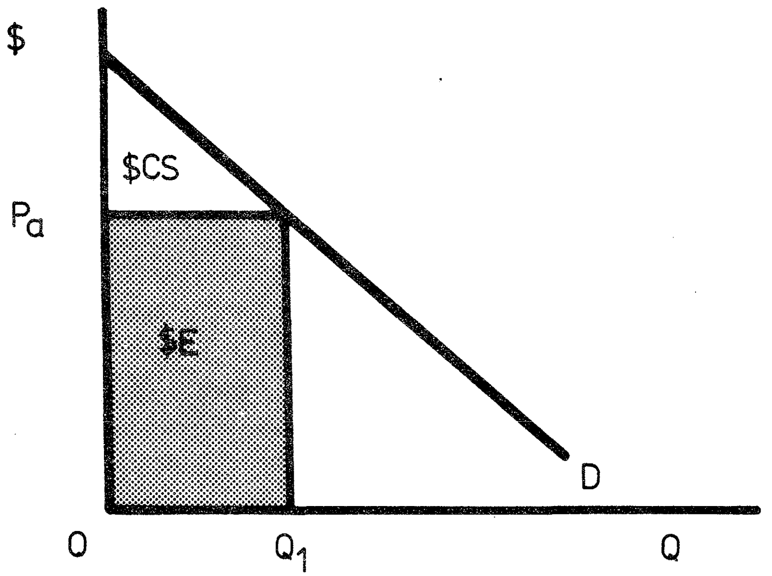


Figure 2.1: Market demand

The market demand curve is therefore a relationship between unit value (willingness to pay, or simply price) and quantity. If Q_1 units are consumed then total value ($V) is given by the sum of what consumers pay ($E) for Q_1 units ($\$P_a \times Q_1$) and consumer surplus

($CS). Consumer surplus is the difference between actual payment and total value. It is the amount a consumer would be willing to pay over and above what is already paid to continue consuming Q_1 rather than nothing of good Q.

Knowledge of consumers' surplus is important for decision-makers. If the sum of individuals' consumer surpluses from a good is greater than the cost of providing the good there is a potential gain in welfare from providing the good there is a potential gain in welfare from provision of the good. In other words, total willingness-to-pay is greater than total cost. There are several different measures of consumers' surplus which are appropriate to policy analysis. In many instances these values are closely related so this study will continue to discuss only Marshallian consumers' surplus, as already introduced. Further discussion of the choice of benefit measure, and the conditions when a potential welfare gain is equivalent to an actual welfare gain is found in Just *et al.* (1982).

A supply curve for Q shows the relationship between its selling price and the total quantity that sellers are willing to supply at each price during a given period. Figure 2.2 shows that suppliers are willing to supply Q_1 units at the price $\$P_b$. The total cost ($C) of supplying Q_1 units is given by the area under the supply curve. Producers' surplus ($PS) is the difference between what producers receive ($\$P_b \times Q_1$) and the total cost of production ($C). An upward sloping supply curve indicates increasing opportunity costs of supplying this product.

We are now in a position to comment on whether or not society's welfare is increased by producing the Q_1th unit. Consider Figure 2.3. The supply curve represents what society must forego to produce Q, total opportunity costs are shown to increase, marginal opportunity cost is positive. Consumers' marginal willingness to pay for Q is given by the demand curve, marginal willingness to pay falls as Q increases. In the following example $\$P_b$ is the marginal opportunity cost of producing the Q_1th unit, $\$P_a$ is consumers'

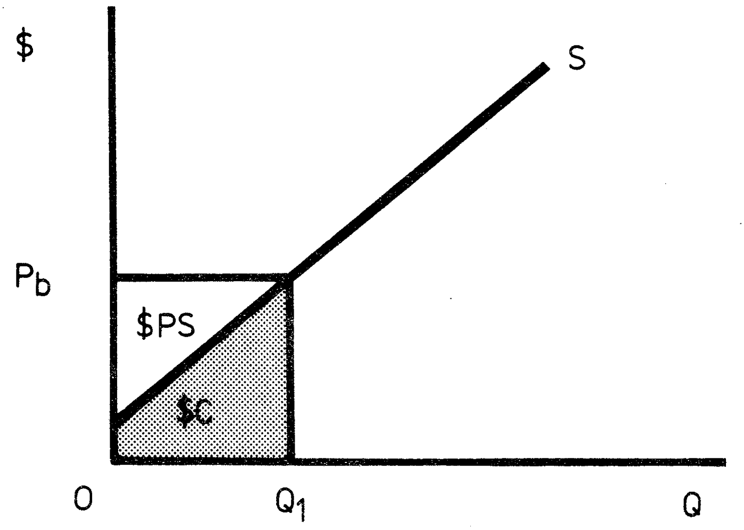


Figure 2.2: Market supply

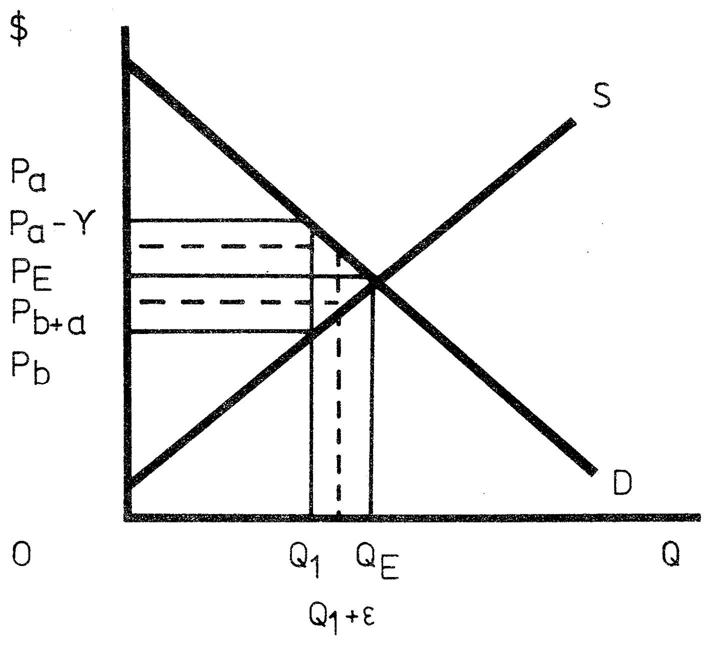


Figure 2.3: Economic costs and benefits

willingness to pay or maginal benefit. The net marginal benefit of the Q_1th unit is ($\$P_a$-$\$P_b$) and it is positive. If consumers were to consider buying $(Q_1+\varepsilon)$ units, their willingness to pay would be given by $\$(P_a-\gamma)$. Suppliers, on the other hand, would be willing to supply $(Q_1+\varepsilon)$ only if the price was $\$(P_a+\alpha)$. The net marginal benefit of producing the εth unit of Q is positive. To ensure economic efficiency at least $(Q_1+\varepsilon)$ units should be produced. In other words, society gains more than it gives up - the principle of opportunity cost in action. Notice that both sets of actors benefit - consumers gain additional consumer surplus and producers gain additional producer surplus. At Q_E, marginal benefit ($\$P_E$) equals marginal cost ($\$P_E$) and the sum of consumers' and producers' surplus is maximized. Or, net social benefit is at a maximum.

The above result rests on the assumptions that

- ▲ there are no signficant external costs and benefits; and
- ▲ benefits and costs are counted as being of equal social importance regardless on whom they may fall.

Optimal pricing rules can be dervied from the following simple model:

$$W(Q) = TB(Q) - TC(Q) \tag{2.1}$$

where

W = welfare, measured in terms of net benefits regardless of their incidence;

TB = total benefit, or total willingness to pay, for Q;

TC = total cost of producing Q; and

Q = market good.

The money metric ($) allows us to express welfare in terms of costs and benefits. If society wishes to maximize welfare then we require

$$\frac{dW}{dQ} = \frac{dTB(Q)}{dQ} - \frac{dTC(Q)}{dQ} = 0$$

$$\rightarrow \quad \frac{dTB(Q)}{dQ} = \frac{dTC(Q)}{dQ} \tag{2.2}$$

or

marginal benefit = marginal cost.

Welfare maximization requires marginal benefit to equal marginal cost. The allocation of resources necessary to sustain this equilibrium is said to be efficient. Economic theory has demonstrated how a competitive market system will achieve the above efficient level of output (Varian, 1978).

2.2 Non-Market Benefits

Conflicting demand for many commodities and services are resolved in market places of the private economy. Those deriving benefit bid against each other for limited supply, and one of the accomplishments of this institutional arrangement is the establishment of a single price for something that affords varied satisfaction to different individuals. In many situations the market mechanism fails to accurately reveal the social benefits and costs of a good or a resource and to allocate them to their best uses (Bator, 1958). The reasons usually cited for "market failure" are:

- ▲ incomplete specification of property rights;
- ▲ collective enjoyment of goods;
- ▲ transaction costs;
- ▲ option and existence values; and
- ▲ imperfect knowledge.

2.2.1 Public goods

The term "public goods" is used to describe a class of goods or services for which the enjoyment by one individual does not preclude simultaneous enjoyment of these very same goods by other individuals (Samuelson, 1954). In other words, they are enjoyed collectively. Once supplied to one individual another individual may enjoy the good or service at zero opportunity cost to the other. In contrast to private goods, the value of an additional unit to society is not just what a single individual would pay but rather the total amount that all individuals would be willing to pay to have an additional amount available. The private market mechanism will under value public goods and therefore under supply them. This is one reason why the supply of public goods has evolved within a non-market institutional framework.

The services associated with parks and protected areas have two features characteristic of public goods. First, a person can usually derive benefit without preventing another person from enjoying the same benefit. Second, it is difficult to force an individual to pay for the service according to the benefit derived (Just *et al.*, 1982). These characteristics are illustrated in Figure 2.4, where society is assumed to comprise two individuals. Each individual is shown to derive value from the commodity/service (Q). Marginal value (MV) is assumed to decline with increasing quantities of Q. For example, Q may represent a particular class of land proposed for national park status. Once a specific area has been preserved ($\bar{Q}$) it is available to both individuals, neither can prevent the other from deriving value from Q. Total marginal value is therefore the sum of each individual's marginal value. Figure 2.4 shows $\bar{Q}$ to be optimal because the marginal cost (MC) of preserving ($\bar{Q}$) equals total marginal value. A competitive market will fail to achieve this socially optimal allocation of resources. The private firm facing MC cannot determine the marginal value of Q to each consumer. Furthermore, once Q has been provided it is not possible to exclude those who do not pay. Some form of government intervention is therefore necessary and it is common for a non-market institution to assume the role of producer, deciding upon the quantity of Q which maximizes social welfare. However, the non-market institution faces the problem of determining people's values so that environmental resources might be allocated in an optimal way, as shown in Figure 2.4.

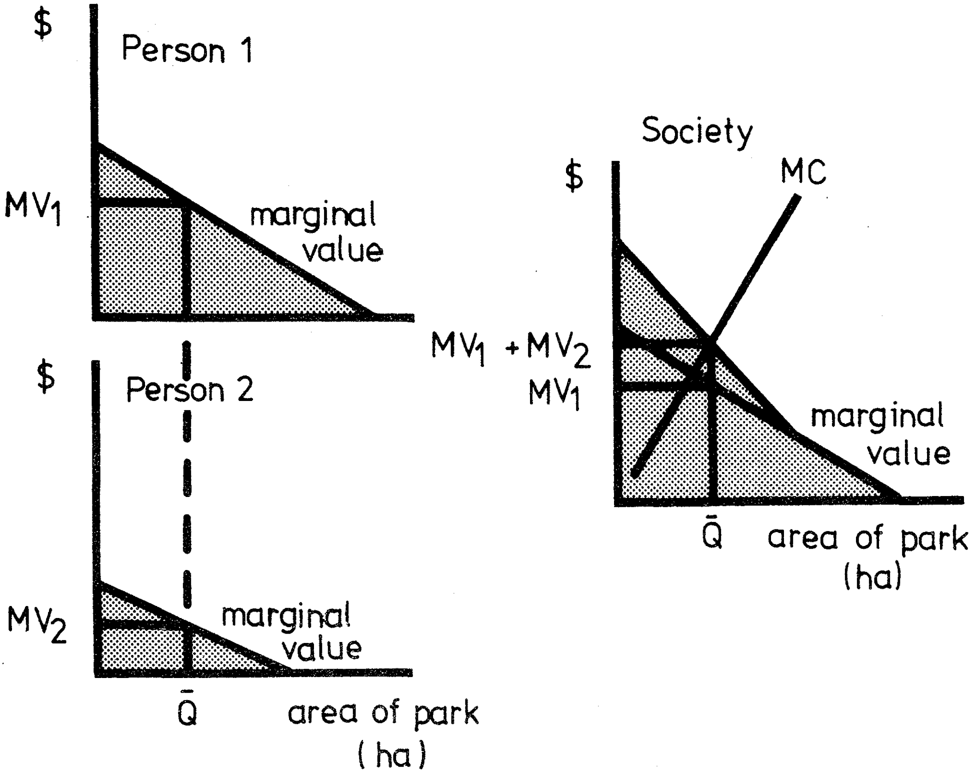


Figure 2.4: Public goods

The services associated with parks and protected areas are provided by a non-market institutional arrangement. In the absence of a market, values must necessarily be imputed to these services if their value is to be compared to the value of other land uses. To ignore these values because they are difficult to estimate is to exclude from consideration many important welfare features of public expenditures on parks and reserves. Information on economic benefits allows a positive approach to questions concerning the mix of national parks and reserves, their location, the timing of acquisition and their development. In addition, the collective gains and losses associated with competing land uses may be assessed.

2.3 Values

We have used the terms value and benefit interchangeably to represent the relative satisfaction obtained from the consumption of market and non-market goods. Recent developments in the valuation of environmental amenities have identified a number of quite separate notions of value. The classes of value are described below in order to clarify the values this study is attempting to measure. Before doing this, three common errors in interpreting an economist's approach to valuing benefits need to be identified:

- the belief that only commercial values are worth considering;
- that valuation necessarily implies commercialisation; and
- that parks and protected areas are outside the scope of economic analysis (Knetsch and Davis, 1966).

Value in economic analysis represents the relative worth, utility, or importance of a commodity or service. The metric of measurement of simply dollars, or the value of other goods and services people are willing to give up to obtain the good in question (McKenzie, 1983). Price is used as an indicator of value in the market. However, because prices do not exist for non-market goods and services alternative measures of value are necessary if economic analysis is to assist in the management and allocation of environmental resources.

Natural resources provide different types of satisfaction to different people. The most obvious value is associated with use. Examples include the value of: a fishery to anglers, a streamside for the family picnic, national parks and state forests to trampers, and a mountain vista to the tourist. The *use values* may only be obtained by travelling to the site in question.

Non-use values of a resource may be received by anyone, whether they are a resource user or not. These include *existence and bequest* *values*. Existence value is the worth of knowing that a resource exists "just to know that it is there". For example, most New Zealanders never expect to see a Kakapo, Takahe, or Black Robin, but are quite happy to see their tax dollars spent on the preservation of these species. Closely related to existence value is the notion of bequest value - the worth of endowing future generations with a natural resource.

A use-related benefit which has recently risen to prominence is *option value*. If an individual is uncertain about future use of a site, say because of uncertain job, health, or personal circumstances, he or she may be willing to pay a premium over and above expected use benefits to ensure that the option to use the site is retained. This is directly analagous to an insurance premium. Freeman (1984) has recently shown that, under most conditions of observed behaviour, option value is positive.

Quasi-option value is the value of maintaining one's options over future use of a resource, and can be thought of as the value of information. Quasi-option value exists in cases where the outcomes of possible future uses of a resource (or even the possible uses themselves) are uncertain, some alternative uses necessitate irreversible changes, and there is some possibility of gaining better information in future. The information has no value if an irreversible change has been implemented before the improved information is obtained. On the other hand, if no irreversible change has been made then the new information may be used to find a more efficient allocation of resources. Retaining a resource in its natural state preserves all options over its future use, and so maximises quasi-option value.

Value in the context of this report is associated with use. This must be quite clear. We are not attempting to estimate existence, bequest and option values. Therefore, our estimate of economic benefit relates only to the values obtained by travelling to Mount Cook National Park. We rely solely on those visitors participating in the recreational opportunities at the Park to derive estimates of economic benefit.

2.4 Economic Basis for Approach

Recreation undertaken at Mount Cook National Park represents one of the major benefits of the Park. It has been argued that recreational experience is not amenable to economic analysis. Some claim that recreational uses of natural resources are not regulated by conventional market arrangements and use appears to be free. Others claim that these benefits are impossible to quantify in terms of the money metric. What makes valuation particularly difficult is the lack of conventional market pricing.

Recreation is not free. As an activity it must compete with other consumer goods and services. An individual makes decisions regarding recreation activity vis-a-vis other activities that are somehow regulated by the market process. Clawson's travel cost method (which is described in more detail later) uses this concept to estimate recreational demand, which can in turn be used to estimate value. The principal argument is that, even in the absence of market pricing, the use of a natural resource for recreation involves consumer expenditures - such as travel, equipment, accommodation and so on. These expenditure regulate consumption. Or, as Wennergren (1964) puts it: the general hypothesis is that travel and on-site expenditures constitute a "price" and are a major determinant of the quantity demand. These expenditure by visitors to national parks are indicators of use value.

2.4.1 Conceptual Model

It is important that a complete conceptual framework be used in this area because it is central to a consistent treatment of modelling consumer choice in outdoor recreational. Following Cicchetti *et al.* (1973) the factors that influence the participation of individual i at site j in activity P are given by

$$P_{ij} = F(E_{1i}, \ldots, E_{ni}; S_{1j}, \ldots, S_{mj}) \qquad \textbf{(2.3)}$$

Where

P_{ij} = level of participation in a given activity of individual i at site j;

$E_{1i}, \ldots, E_{ni}$ = socio-economic characteristics of individual i; and

$S_{1j}, \ldots, S_{mj}$ = supply characteristics of site j and its relevant substitutes.

The variable P_{ij} is therefore the individual's observed recreation decision. Most of the approaches used to model recreation decisions can be considered within the framework of equation 2.3.

The value of an environmental resource to an individual is measured by what the individual is willing to pay. Traditional theory postulates that the value an individual places on an incremental unit of a commodity declines as the number of units consumed increases. Therefore, the consumer will purchase the commodity up to the point where the value of the last unit exactly equals price. The assumed behaviour of this marginal value function underlies the downward sloping demand function shown in Figure 2.5 and the notion of consumer surplus shown in Figure 2.1.

So, if price is OP_1, then total value as measured by willingness to pay is $ODRQ_1$. However, only OP_1RQ_1 is paid so the net value, over and above payment, is P_1DR or consumer surplus. If we have a statistical demand function for equation 2.3 and we expect a change in price then the change in consumer surplus measure of welfare change is found by:

$$Q = F(P)$$

$$CS = \int_{P_2}^{P_1} F(P)dP$$

$$= P_1RSP_2$$

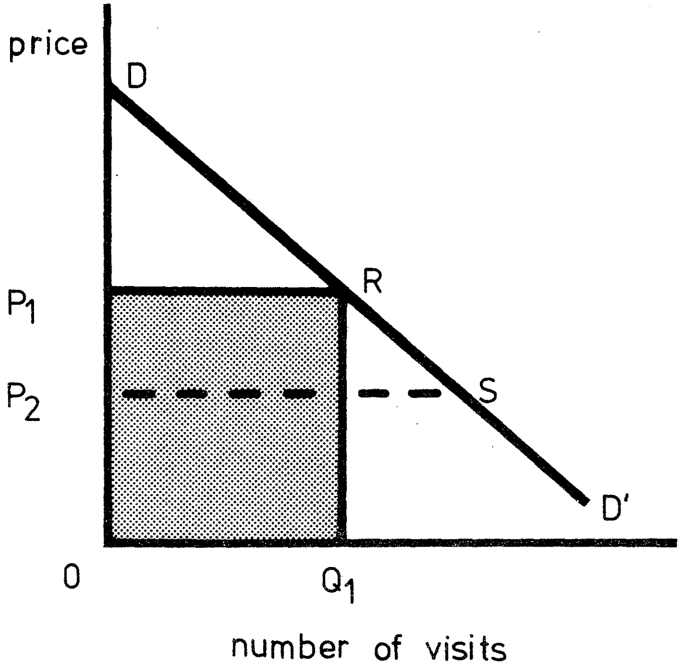


Figure 2.5: Consumer demand for recreation

The Hotelling-Claswon-Knetsch (HCK) method makes use of the fact that to participate in recreation, the individual allocates a large portion of total costs to the cost of travel. That is, a large fraction of the individual's marginal valuation is captured by the cost of travel to the site. Variability in travel cost is used to identify a demand equation for an outdoor recreation site. It is clear that this method is best suited for estimating demand for relatively remote, resource-based recreation sites, not for population based facilities in urban areas such as Hagley Park in Christchurch where travel costs are likely to be insignificant compared to other costs of a visit. The HCK method is decribed in more detail in Chapter 4.

3. Regional Economic Benefits

In this study primary benefits are the use values associated with Mount Cook National Park. Primary costs measure the opportunity costs of using the resources allocated to acquire and maintain the National Park. Estimates of primary benefits and primary costs are necessary for comprehensive economic analysis of changes in government expenditures and national park policy. For example, decision-makers might be interested in the net benefits associated with changes in policy regarding increased commercial activity within national parks.

National parks are part of regional economies. Changes in park management, and policy, are therefore likely to have economic consequences at the regional level. Consider employment. The location of jobs associated with a park are of little consequence in a national cost-benefit analysis. In a national-level study, it is irrelevant that visitor expenditure in towns close to Mount Cook National Park contributes to regional employment opportunities. That is, a national-level study gives equal weight to employment opportunities wherever they occur in New Zealand. However, from a regional perspective the location of employment opportunities may be important. In this chapter we describe some of the methods for assessing the effects of national park visitor expenditures on regional economies.

3.1 Secondary Benefits and Costs

Secondary benefits result from economic activity generated in the process of realizing primary benefits. At the national level, secondary benefits reflect the impact of a project on the rest of the economy (Eckstein, 1958). Secondary effects relate to impacts on those individuals and firms who service primary beneficiaries as well as individuals and firms in other interdependent sectors of the economy. For example, firms in the accommodation sector may realize benefits (in the form of increased income) from servicing package tours on their way to Mount Cook National Park. As a result, employment opportunities may increase and more jobs may result in higher levels of total income. Multipliers are summary measures of this economic interdependence.

The use of estimates of secondary benefits and costs in national cost-benefit analysis has been severely criticised (Eckstein, 1958; McKean, 1958). Gittinger (1972) lists the conditions under which the full multiplier-effects constitute a real net change in welfare.

- Public expenditure is not financed out of tax revenues so that the multiplier-creating expenditures are not drawn away from the private sector;
- conditions of supply for all factors stimulated to employment by the investment are perfectly elastic at prevailing prices;
- opportunity costs of those factors in the absence of investment is zero; and
- outputs which result do not simply substitute for other products in the market place and, thus, do not result in unemployment for other factors of production (Gittinger, 1972, p.27).

It is most unlikely that these conditions apply in practice, and never in a "properly functioning" price system where goods sell for their cost of production. Of course, markets are not always perfect, often containing: monopolies, monopsonies, distorting government subsidies or taxes, and so on. In these cases most authors recommend the use of 'shadow pricing'. That is, inputs are valued at their opportunity cost to society, not the cost to the purchaser (Gittinger, 1972, p.26). If shadow prices are employed there are no secondary benefits. For example, instead of using market prices to evaluate a project in an area with high unemployment and also finding the number of jobs created, it is simpler to use shadow prices. In this case it could be claimed that the shadow price (opportunity cost) of labour is zero. The analysis is then conducted in the usual way.

The estimation of secondary benefits and costs from a regional point of view is less hazardous because of the "openness" of a regional economy (Sassone and Schaffer, 1978). However, attention is now diverted from "benefit counting" to the problem of defining regional objectives. *If regional development is recognised as an objective, then the estimation of secondary benefits is meaningful.* Regional changes in income and employment from the project under review may then be compared with the regional changes induced by alternative projects. These secondary impacts are only useful in a comparative sense, and not as an absolute measure of value.

3.2 Economic Multipliers

In Keynesian theory, a multiplier measures the relationship between an autonomous injection of expenditure into an economy and the resultant change in incomes which occurs (Archer, 1977). Tourist spending is an autonomous injection of expenditure which creates a stimulus to economic activity within the affected area, which in turn, generates additional net income and employment.

The expenditures of visitors to Mount Cook National Park, and its environs, are called direct expenditures. Direct expenditures by visitors to the Park are injections of money into the regional economy. Consider the example shown in Figure 3.1 where a visitor spends $100 on accommodation. Direct revenue to the region is $100.

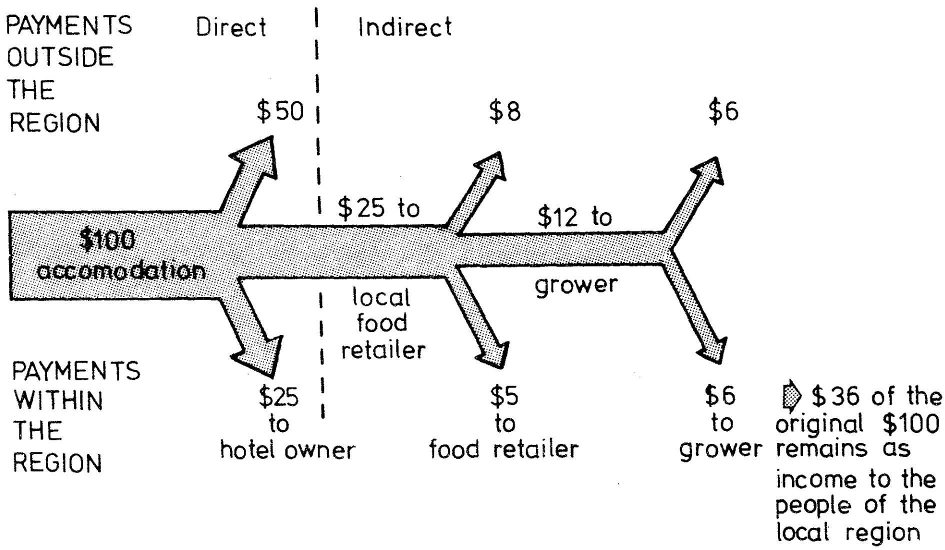
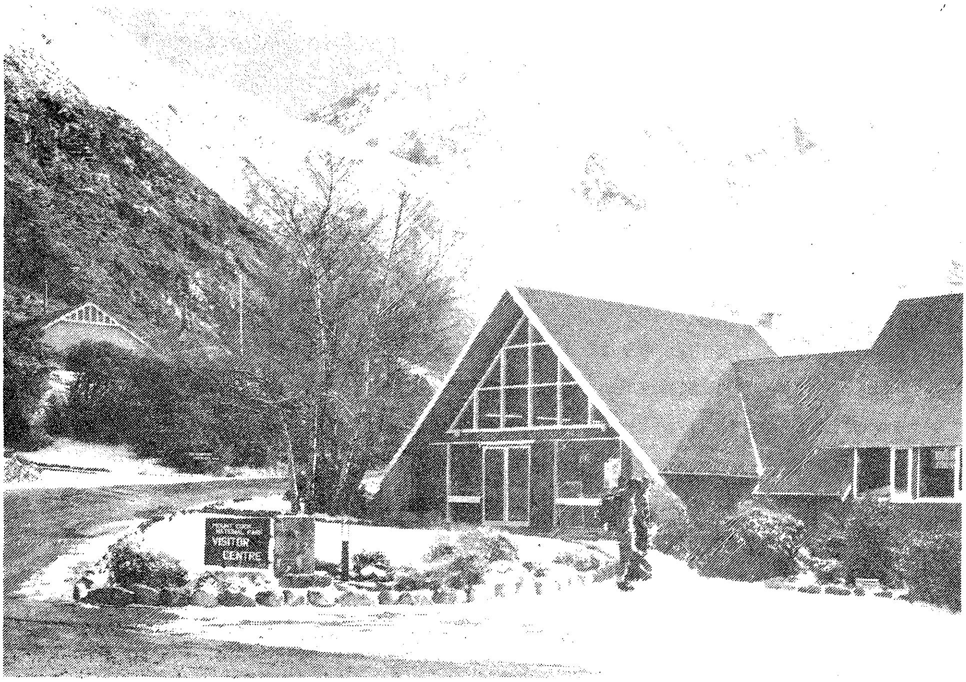


Figure 3.1: Hypothetical flow of transactions stemming from $100 accommodation purchase

However, not all this money generates income to the resident population. Some of the revenue will leak out of the region, say as a payment to mortgagees ($50), some of the revenue will be used to buy inputs (such as food) $25, and the remainder goes to shareholders (which we assume are in the region) $25. Food retailers receive $25 from the hotel owner, $8 leaks from the region, $5 goes to shareholders and $12 goes to local vegetable growers. Local vegetable growers receive $12, $6 leaks from the region and $6 profit accrues to the grower.

The indirect effect of the initial $100 expenditure is shown in Figure 3.1. The magnitude of indirect effects is governed by the nature and extent of the inter-industrial linkages. Few inter-industry links may exist in remote areas and, as a consequence, leakages outside the region are high. As wages and salaries rise within a region, so local consumption increases, which in turn gives additional impetus to economic activity. These are called induced effects.



Visitors Centre, Mt Cook National Park.

Three types of tourism multiplier in common use are:

- ▲ Output multiplier: relates a dollar of tourist spending to the increase in output in the economy. Output multipliers account for sales and any real changes in inventories.

- ▲ Income multiplier: shows the relationship between an additional dollar of tourist spending and changes in the level of income. The definition of income is most important; usually it is defined as disposable income.

- ▲ Employment multiplier: describes the change in employment generated by an additional dollar of tourist spending.

3.3 Economic Base Multipliers

The economic base of a region is assumed to comprise industries (referred to as basic industries) which export goods and services to other regions. Non-basic industries are service oriented and their level of economic activity is assumed to depend on levels of economic activity in the basic industries. Base theory assumes that the size of the export base is the sole determinant of the levels of income and employment within a region.

Export base theory has at least three shortcomings (Archer, 1977). First, the distinction between "basic" and "non-basic" is, in practice, quite arbitrary. Second, there is an assumption that unemployed resources will provide for the required level of production. Third, income and employment levels within a regional economy also depend on things other than the size of the export base. For these reasons, economic base models have been rejected in favour of models based on the Keynesian formulation, or input-output analysis.

3.4 Keynesian Multipliers

Keynesian multipliers are based on an assumption that the impact of an initial injection of expenditure in the regional economy diminishes according to a geometric progression. Figure 3.1 showed leakages to occur at each round of expenditure. If we let

e = the propensity to spend within the regional economy;

$(1-e)$ = the leakages which occur per unit of expenditure; and

E = the extra visitor expenditure.

Then the additional income generated is given by

$$Y = E + e\,E + e^2\,E + \ldots$$

$$= \frac{E}{1 - e} \qquad \textbf{(3.1)}$$

This concept is evident in many studies of the economic impact of visitor expenditures in areas close to national parks. For example, the model used by Dean *et al.* (1978) to estimate the total income generated locally from expenditures takes the form

$$Y = E\left[\frac{a}{1-bxc}\right]$$

where

a = proportion of tourist's expenditure which remains in the region after leakages from the actual spending itself;

b = proportion of their income that local people spend on locally produced goods and services; and

c = proportion of local people's expenditure that becomes incomes for other people.

From their cross-sectional analysis of five parks, Dean *et al.* conclude:

▲ Direct primary payroll effects of park expenditures are of minor interest.

▲ Secondary impact of state and visitor expenditures is a more useful perspective.

▲ Because of park location, most materials are imported, thereby generating few insignificant local economic impacts beyond the direct effect of the payroll.

Archer and Owen (1971) extended the Keynesian model to enable a more detailed analysis of tourist expenditures. However, the Keynesian model is unable to fully account for the different effects of increased spending in different industries in the regional economy. The input-output model, which can be considered the limiting case of extensions to the Keynesian model, allows this type of analysis.

3.5 Input-Output Multipliers

An input-output (I-O) model of an economy consists of a matrix detailing flows of goods between all industries represented in the economy. The general format of an I-O matrix is illustrated in Figure 3.2. Each industry is assigned a row and a column. The element X_{ij} in row i and column j indicates the volume of goods flowing from industry i to be used as inputs in industry j. These inter-industry flows may be measured in either physical units or in dollar values. The latter is preferable as it allows the summation of row and column elements to evaluate industry total values.

TO INDUSTRY

FROM INDUSTRY	1	2	j	n		TOTALS
1	X_{11}	$X_{12}\cdots$	$X_{1j}\cdots\cdots$	X_{1n}	D_1	X_1
i			X_{ij}		FINAL DEMAND	GROSS OUTPUT
n	X_{n1}	$X_{n2}\cdots$	$X_{nj}\cdots\cdots$	X_{nn}	D_n	X_n
	P_1	P_2	primary inputs	P_n	Primary inputs directly entering final demand	
TOTALS	X_1	$X_2\cdots$	$X_j\cdots\cdots$	X_n		GRAND TOTAL

Figure 3.2: Inter-industry flows

Industries require inputs not only from other industries in the economy but also from households (labour), industries outside the economy (imports), and other primary inputs. Similarly, not all output is consumed by other industries, the difference entering final demand which consists of: exports, household consumption, stock accumulation, and government spending. Flows of primary inputs may directly enter final demand. An example of this is imports of goods for consumption by households.

It can be seen that the I-O model provides a complete yet concise summary of an economy. By assuming that industries and households are homogeneous in the first degree (constant returns to scale) it is possible to identify the requirements of resources, and of outputs from any industry, in response to changes in final demand.

The economy represented in Figure 3.2 produces a gross output of X_1 from industry 1, X_2 from industry 2, and so on. A portion of the gross output of industry 1 is required as input to industry $1(X_{11})$, X_{12} is required as input to industry 2, and so on. The gross output of any industry i is used either as inputs to other industries (X_{11}, X_{12}, ..., X_{1n}) or enters final demand (D_1), providing the following relationship.

$$X_i = \sum_{j=1}^{n} X_{ij} + D_i; \text{ for all } i,\ i \in (1,n) \qquad \textbf{(3.2)}$$

where

X_i = gross output of industry i;
X_{ij} = output from i used by industry j; and
D_i = final demand for output of industry i.

If it requires X_{ij} units of output from industry i to product X_j units of output in industry j, then to produce one unit of j would require $X_{ij}/X_j = a_{ij}$ units of output from industry i. The a_{ij}'s are known as input-output coefficients.

Since $$a_{ij} = \frac{X_{ij}}{X_j}$$

then $$X_{ij} = a_{ij}X_j \tag{3.3}$$

combining (3.2) and (3.3)

$$X_i = \sum_{j=i}^{n} a_{ij}X_j + D_i; \text{ for all } i, \ i \in (1,n)$$

or, in matrix notation;

$$X = AX + D$$

$$\rightarrow X = (I-A)^{-1}D \tag{3.4}$$

where

X = (n x 1) matrix of gross inputs;

D = (n x 1) matrix of final demands;

A = (n x n) input-output coefficient matrix; and

I = (n x n) identity matrix.

The (I-A) matrix is known as the Leontief matrix. The coefficient matrix (A matrix) indicates direct output requirements from each industry to produce one unit of output in any industry. Suppose we have a simple economy consisting of three inter-related industries.

Then

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

The unit (dollar) of output from industry 1 directly requires a_{11} units of input from industry 1, a_{21} units from industry 2, and a_{31} units from industry 3. However, each of these industries requires extra inputs to be able to produce these direct requirements. These are known as indirect output requirements. Suppose final demand is one unit of output from industry 1.

Equation 3.4 tells us

$$X = (1-A)^{-1}D$$

so, for our three industry example

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} b_{11} \\ b_{21} \\ b_{31} \end{bmatrix}$$

Total direct plus indirect output requirements for each industry for one unit of ouput from industry i ae given by the column i inverse Leontief matrix coefficients (b_{11},b_{21},b_{31}).

It has been shown that an increase in final demand for any good has repercussions throughout the whole economy, causing increases in output beyond the initial change in demand. This is known as the multiplier effect. Multipliers vary between industries depending upon how reliant the industries are on imports, and inputs from other industries. Increases in output affect household incomes through changes in demand for household inputs, and affect employment because of increased demands for labour.

3.5.1 Output Multipliers

The *simple output multiplier* for industry j ($T1OM_j$) accounts for direct and indirect output requirements in all industries due to a unit increase in final demand from industry j. This is found by summing the jth column coefficients of the inverse Leontief matrix, since these coefficients show direct plus indirect requirements from each industry.

$$T1OM_j = \sum_{i=1}^{n} b_{ij}$$

Increased output increases household incomes, and so induces consumer spending, further increasing final demand. The *total output multiplier* ($T2OM_j$) accounts for direct, indirect, and induced changes in output from a unit increase in final demand from industry j. To account for this induced effect the household can be included in an expanded A matrix. This treats households as an industry, producing income and requiring inputs from other industries (household consumption).

$$A^* = \left[\begin{array}{c|c} \begin{bmatrix} \\ \\ A \\ \\ \end{bmatrix} & \begin{matrix}\text{Household} \\ \text{demands}\end{matrix} \\ \begin{bmatrix}\text{Household inputs}\end{bmatrix} & 0 \end{array}\right] = \begin{bmatrix} A_{11} & \cdots & A_{1n} & H_1 \\ \cdot & & & \cdot \\ \cdot & & & \cdot \\ \cdot & & & \cdot \\ \cdot & & & \cdot \\ A_{n1} & \cdots & A_{nn} & H_n \\ L_1 & \cdots & L_n & 0 \end{bmatrix}$$

Households cannot directly consume their own labour so $A_{n+1,n+1}$ is set to zero. By an indentical argument to that used in developing total output requirements it can be deduced that

$$T2OM_j = \sum_{i=1}^{n} b_{ij}^*$$

where b_{ij}^* is an element of the expanded inverse Leontief matrix.

3.5.2 Income Multipliers

Effects on household income and employment usually hold more importance than output changes. Any increase in output requires more inputs from households, the L_i coefficients in A*. The *direct income multiplier* for industry j (DIC_j) is therefore given by

$$DIC_j = L_j$$

Direct plus indirect requirements from industry i for a unit increase in demand in j is b_{ij}. Each unit of output from industry i requires L_i units of input from households. Direct plus indirect income to households supplying industry i is $b_{ij}L_i$. Household output may change in all industries to satisfy the change in demand for j so household income changes must be summed over all industries to give the *direct plus indirect income multiplier* for industry i ($DIIC_j$).

$$DIIC_j = \sum_{i=1}^{n} b_{ij}L_i$$

It was shown that the elements of the $(I-A^*)^{-1}$ matrix (the b_{ij}*'s) represent direct, indirect and induced output from each industry in response to a change in final demand. The *direct, indirect and induced income multiplier* ($DIIIC_j$) is then nothing more than the element from column j and the household row of the $(I-A^*)^{-1}$ matrix:

$$DIIIC_j = b_{Lj}^*$$

The preceding income multipliers may be used to derive more income multipliers.

Type I income multiplier ($T1IM_j$) is simply the ratio of direct plus induced income effects to direct income effects.

$$T1IM_j = \frac{DIIC_j}{DIC_j} = \frac{\sum_{i=1}^{n} L_i}{L_j}$$

Type II income multiplier ($T2IM_j$) is the ratio of direct, indirect and induced income effects to direct income effects.

$$T2IM_j = \frac{DIIIC_j}{DIC_j} = \frac{b_{Lj}^*}{L_j}$$

3.5.3 Employment Multipliers

Employment is not explicitly included in I-O models, but effects on employment may be found by calculating the employment coefficients for each industry (e_i). Employment coefficients represent the number of people directly employed by that industry per dollar of industry output. That is:

$$e_j = \frac{N_j}{X_j}$$

where

e_j = employment coefficient for industry j;
N_j = number of people employed in industry j; and
X_j = gross output of industry j.

Employment multipliers may now be developed in exactly the same manner as income multipliers.

Direct Employment Multiplier	$EC_j = e_j$
Direct plus Indirect Employment Multiplier	$DIEC_j = \sum_{i=1}^{n} b_{ij} e_i$
Direct, Indirect and Induced Employment Multiplier	$DIIEC_j = \sum_{i=1}^{n} b^*_{ij} e_i$
Type I Employment Multiplier	$T1EM^j = \dfrac{\sum_{1=i}^{n} b_{ij} e_i}{e_j}$
Type II Employment Multiplier	$T2EM_j = \dfrac{\sum_{1=i}^{n} b^*_{ij} e_i}{e_j}$

	Output	Income	Employment
Direct	a_{ij}	L_j	e_j
Direct plus indirect	$\sum_{i=1}^{n} b_{ij}$	$\sum_{i=1}^{n} b_{ij}L_j$	$\sum_{i=1}^{n} b_{ij}e_i$
Direct indirect plus induced	$\sum_{i=1}^{n} b^*_{ij}$	b^*_{Lj}	$\sum_{i=1}^{n} b^*_{ij}e_i$
Type I	-	$\dfrac{\sum_{i=1}^{n} b_{ij}L_i}{L_j}$	$\dfrac{\sum_{i-1}^{n} b_{ij}e_i}{e_j}$
Type II	-	$\dfrac{b^*_{Lj}}{L_j}$	$\dfrac{\sum_{i=1}^{n} b^*_{ij}e_i}{e_j}$

Table 3.1: Multiplier definitions for a unit increase in demand for industry j

3.6 Limitations

Each of the above models has certain merits. Economic base models require minimal data. However, they offer limited insights into the economic linkages that exist between a park and a regional community. On the other hand, input-output models require extensive data while offering superior policy-relevant insights into economic interdependence. Such is the nature of the trade-off. In this section we identify some of the deficiencies associated with multiplier studies in general.

3.6.1 Data Requirements

Good data are needed to obtain meaningful estimates of regional multipliers. Usually an adequate data base does not exist for use in Keynesian-type models or in input-output models. Data problems are exacerbated by the nature of tourist and recreation activity itself. Many commercial activities within the study region are multi-product firms - offering a number of services to visitors. This means that visitor expenditures are spread across a range of activities and a survey of visitors is needed to obtain a breakdown of the pattern of expenditure into principal groupings, such as accommodation, food, ski-plane flights, guiding and so on.

Assuming good visitor expenditure data are obtained from a survey, there remains a problem of meshing the grouping of expenditures with an input-output or Keynesian-type model. In many cases the data obtained from visitor surveys have to be meshed with highly aggregated input-output tables. If resources are available to obtain sectoral data for the region, as opposed to relying on national-based tables, then it is highly likely that the accuracy of multiplier estimates is enhanced. Armstrong *et al.* (1974) did, however, counter this argument by showing that their results were relatively insensitive to changes in the allocation of expenditure across sectors in their input-output table.

3.6.2 Model Assumptions

Base theory models and simpler Keynesian-type multipliers fail to account for sectoral differences in input structure. Input-output models are required in order to show the impact of various categories of visitor/tourist. Although input-output models capture the essence of inter-industry linkages they too do have a number of limitations.

- ▲ Production and consumption functions for each sector are linear. Any further production requires purchases on inputs in the same proportions as previously. Economies of scale, if present in the economy, are not represented. Moreover, the existing pattern of trade between sectors is assumed to remain stable.

- ▲ Supply is usually assumed to be elastic in all sectors of the economy. This means that the increase in output required to service increases in final demand can be met from the existing supply sectors. Technical constraints, supply bottlenecks, and changes to supply price, may result in lower multiplier values in practice.

- A static model takes no account of the time taken for the full impact of the multiplier to be registered. Diamond (1976) has shown that different multipliers can result from different estimates of how fast the transactions occur within an economy. This may prove to be important when planning for major development.

3.6.3 Conclusion

Good data on visitor expenditures are important determinants of multiplier accuracy. The cost of developing an input-output model for a region is probably beyond the budget of most funding agencies. Moreover, it is highly likely that the proprietary nature of the data will not result in industry co-operation. It therefore remains a matter of judgement as to the meshing of visitor expenditure patterns with interindustry tables.

The idea behind multiplier analysis is to provide meaningful insights into the linkages that exist between visitor expenditures and regional economic impact. Ideally, a model should be robust enough to withstand fairly substantial changes in the values of the coefficients, yet sensitive enough to react to changes in the pattern of visitor expenditures (Archer, 1977). Sensitivity analysis - incorporating changes to coefficients and visitor expenditures - is therefore an integral part of estimating the regional economic benefits of a national park.

4. Travel Cost Method

The primary benefits of Mount Cook National Park are based on the concept of willingness to pay. At the conceptual level we have shown that total willingness to pay is equal to the sum of gross expenditures, money that people actually spend to enjoy the natural amenity, plus consumers' surplus. Our objective now is to present an empirical method that serves to provide the quantitative information required.

The travel cost method is a widely accepted technique for the valuation of natural environments. Reasons for its wide acceptance include simplicity and its being based on what people actually do rather than what they would claim to do under a hypothetical situation. The travel cost method has been used to estimate the economic benefits of protected natural areas throughout the world (Nautiyal and Chowdhary, 1975; Smith, 1975; Woodfield and Cowie, 1977; Schwalbe, 1978; Smith and Kopp, 1980; Ulph and Reynolds, 1981; Haspel and Johnson, 1982).

A general hypothesis is presented first which allows us to establish the proposition that demand is a function of travel costs. Then we present an overview of the aggregate travel costs method, identifying the assumptions involved at each step in the derivation of the demand curve.

4.1 Basic Concept

A general hypothesis for estimating the use value of non-market priced recreational resources is

> "...individual user costs to and from a particular ... site, plus the added on-site expenditures, constitute a "price" ... and, as such, are the principal determinants of the quantity that will be taken." (Wennergren, 1964, p.305)

The following assumptions regarding behaviour and the measurement of utility are basic to the information of the model proposed by Wennergren.

- ▲ Income is spent so as to maximize satisfaction.
- ▲ The visitor has perfect knowledge about costs and the satisfaction gained from different "quantities" of recreation.
- ▲ The recreation activity is pursued to a level at which marginal utility equals marginal cost - including opportunity cost.
- ▲ Units of utility and cost are equivalent.
- ▲ Major decisions pertaining to individual trips are made prior to departure.

A prospective climber, for example, faces an early choice - will the initial decision to buy equipment exceed the benefits which will result from the activity? If the prospective climber buys the equipment, this would suggest that the value of the expected utility of all climbing is at least equal to the expected cost. However, once the decision is made, these costs now become fixed costs for the climber and must be incurred regardless.

The marginal cost associated with each trip is the relevant variable for comparing with the additional utility obtained. A decision to visit the park suggests that the marginal cost (MC) of the climbing visit is less than, or equal to, the value of the additional utility (MVU). The marginal cost would include the cost of travel. Because we have assumed diminishing marginal utility, the total number of trips taken during the season will be such that MC equals MVU.

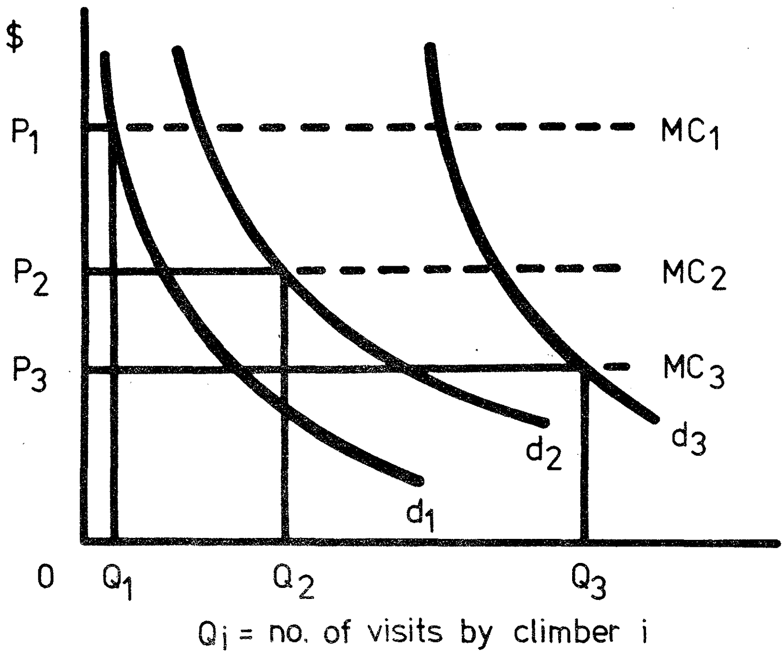


Figure 4.1: Individual demand

Conceptually, a demand function relating the number of trips taken to a given site at alternative prices exists. This is illustrated for three different climbers in Figure 4.1. The level and elasticity of each demand function (d_i) will depend on the individual's income, tastes, and the quality of the site. Price is defined as the travel and on-site costs associated with each trip. More distant climbers have higher prices. If the price of visiting the site is P_i for climber i then Q_i visits will be made.

Aggregate demand for a given climbing site defines the number of climbing visits which would be taken at the site by climbers coming from different origins. Individual demand curves, as shown in Figure 4.1, are conceptual and it is possible only to observe the point defined by the optimal visitor behaviour - marginal cost equals marginal utility. It is not possible therefore to sum entire individual demand curves - summation is based on one point on the individual demand schedule. Aggregation of individual demands to derive the demand for the climbing site is

$$D(P) = \sum_{i=1}^{n} D_i(P) \tag{4.1}$$

where

$D(P)$ = aggregate demand for the site at entry price P; and

$D_i(P)$ = the ith individual's demand at entry price P.

In Chapter 2 we suggested that the economic value derived from a given resource use is the value it has for consumers as measured by their willingness to pay for its use. It follows, therefore, that the area under the demand curve D(P) represents the value of the resource.

4.2 Aggregate Travel Cost Method

Hotelling suggested the initial idea for calculating the demand for a resource by defining concentric distance zeros around a recreational site and comparing per capita visitation rates in those zones with the travel costs associated with use of the resource. This method assumes that visitors from the furthest zone are maginal users; that is, they are indifferent about using the resource at the level of costs they must incur in travel. Users who live closer to the resource derive consumers' surplus equal to the difference in travel costs. Hotelling's suggestion was refined by Clawson (1959) to provide the now commonly used Travel Cost Method (TCM).

4.2.1 An Example

The travel cost method is best illustrated by an example. Site visitors are groups in zones according to the distance they must travel to reach the site (Table 4.1).

Zone	Population	Cost per Visit	Number of Visits	Visits per 1000 Base Population
1	1 000	$1	500	500
2	4 000	$3	1 200	300
3	10 000	$5	1 000	100

Source: Clawson and Knetsch (1966)

Table 4.1: Visitor and population data

The number of visits per head of population in each zone is then plotted against cost per visit (Figure 4.2) in what we shall refer to as the preliminary demand curve. This is not the demand curve for the

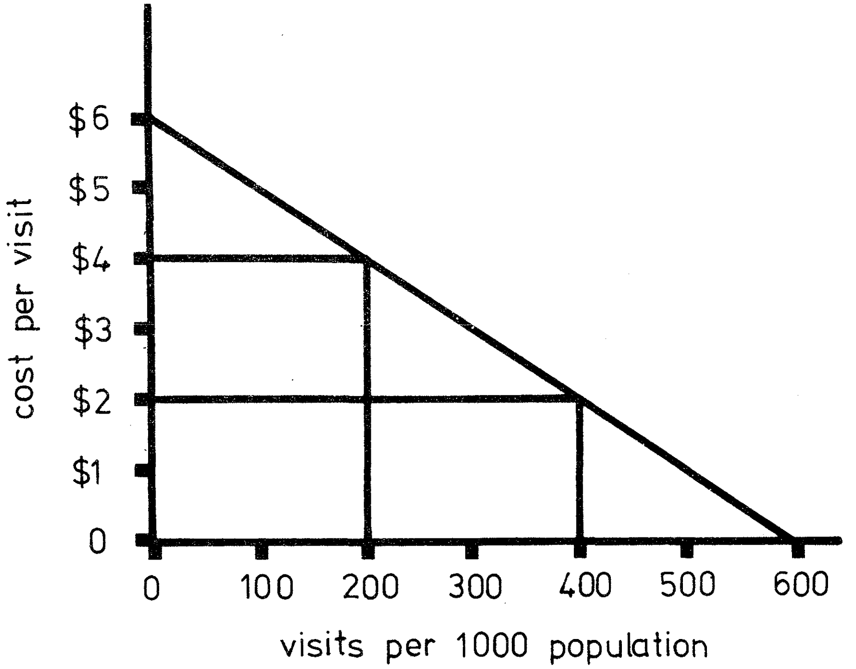


Figure 4.2: Preliminary demand curve

site, but it does tell us how the visitation rate for each zone changes with a change in costs, and so can be used to construct the demand curve (Table 4.2 and Figure 4.3). For example, site visits from zone 2 initially face a cost of $3 per visit and make 300 visits per thousand, for a total of 1 200 visits. If an entry fee of one

Zone	No. of Visits at Added Cost per Visit of					
	$0	$1	$2	$3	$4	$5
1	500	400	300	200	100	0
2	1 200	800	400	0	0	0
3	1 000	0	0	0	0	0
Total attendance:	2 700	1 200	700	200	100	0

Source: Clawson and Knetsch (1966)

Table 4.2: Construction of the demand curve

dollar was placed on the site, then zone 2 users would face a cost of $4 per visit, which indicates a visit rate of 200/1 000 (moving back up the visitation rate curve), or 800 visits. The notion of an entry fee in this example is a hypothetical construction. A demand cure shows how use varies with cost. We know the level of use at present cost and want to know how this changes when costs increase identically for all visitors. A hypothetical entry fee is an intuitively appealing way of describing these changes in cost. Other means, such as changes in petrol prices, are equally valid. Similarly, a further one dollar fee increase causes the number of visits from zone 2 to drop to 400. By aggregating visits from all zones for each imposed entry fee, it is possible to define the aggregate site demand curve shown in Figure 4.3. Total consumers' surplus is given by the area under the demand curve. The method, as illustrated here, relies on assumptions of single purpose trips, equality of substitutes across zones, and a zero valuation of travel time. In practice the method

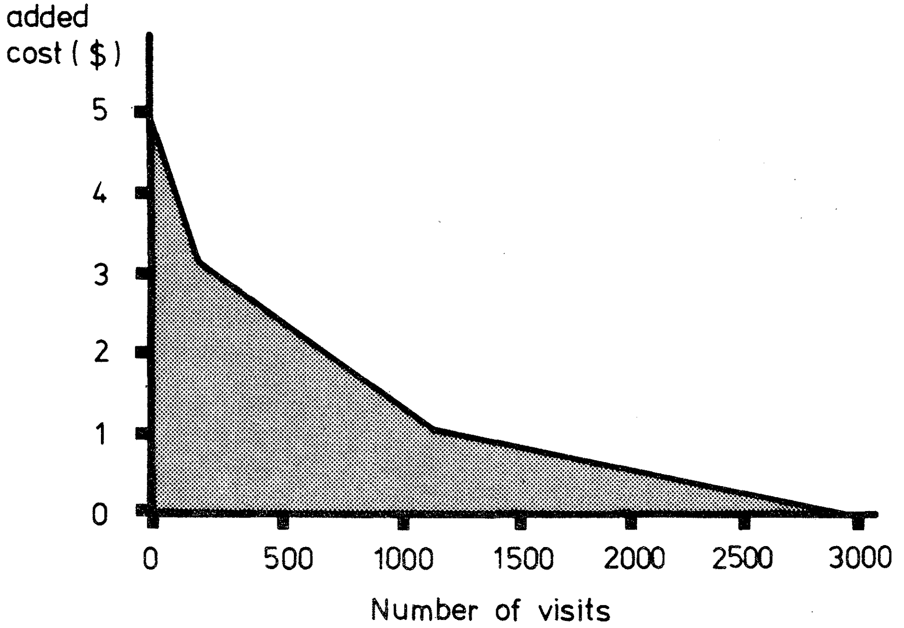


Figure 4.3: Demand curve

can be refined to account for all these assumptions, and by reducing the numbers in each zone can even account for many socio-economic variations between zones.

The travel cost method for estimating the aggregate demand curve of a site rests on the assumption that use of a site is dependent upon the costs incurred in that use which, for free access public recreation sites, are usually limited to the costs of travel. For any given population it could be expected that, *ceteris paribus*, if the price of travel to reach a site increased, then use of the site by that population would decrease.

$$D_{ij} = f_i(TC_{ij}) \qquad \textbf{(4.2)}$$

and, $f_i' < 0$

where

TC_{ij} = cost of travel to site i for population j; and
D_{ij} = annual number of visits to site i by members of population j.

By assuming that:

- ▲ tastes are similar for all populations;
- ▲ travel is for use of site i only;
- ▲ people respond to an entry fee in the same manner as an increase in travel costs;

it is possible to derive the aggregate demand curve for a site. Equation 4.2 may be transformed to express visits from differing populations as a per capita rate:

$$\frac{D_{ij}}{Pop_j} = g(TC_{ij} + E_i) \qquad \textbf{(4.3)}$$

where

E_i = entry fee to site i; and
Pop_j = number of people in population j.

Site use data can be used to provide values of D_{ij}/Pop_j where the populations refer to people living in zones with different travel costs to reach site i (TC_{ij}). The entry fee (E_i) is zero in all cases, so the function g in equation 4.3 may be estimated. By varying E_i it is possible to estimate visitation rates, and hence total visitor numbers, from each population at any given entry fee. Aggregation of visits across populations allows the aggregate site demand curve to be plotted.

4.3 Limitations of the Model

The assumption of similarity of tastes is clearly unrealistic. If the model of site demand is to be properly specified it is important that measures of tastes and ability to use a site are included. These variables may include measures of income (Y), education (Ed), age (A), whether the population is rural or urban (R), availability of substitutes to site i (S), and other variables which may be proxies for tastes or abilities (ϕ_j).

$$\frac{D_{ij}}{Pop_j} = h_i(TC_{ij} + E_i, Y_j, Ed_j, A_j, R_j, S_j, \phi_j) \qquad \textbf{(4.4)}$$

4.3.1 Substitutes

It is necessary that the availability of substitute activities is similar between zones. This will often not be true. Those travelling from more distant zones will usually have a wider choice of substitutes. This is illustrated in Figure 4.4. For no more than the cost of visiting site A, residents of zone 1 can visit any area within the region defined by circle 1, whereas residents of zone 2

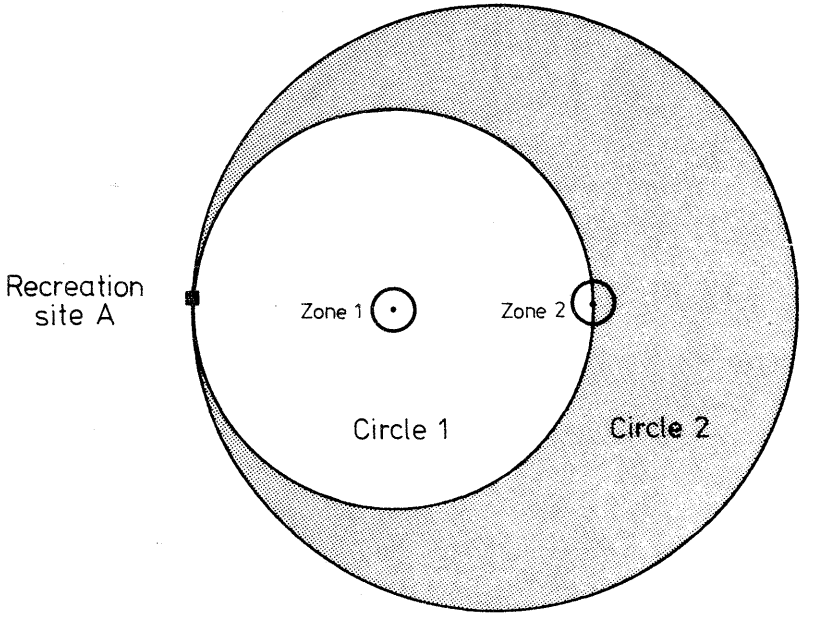


Figure 4.4: Effect of distance on number of substitutes available to recreationists

can visit any point within circle 2. Zone 2's opportunities include all those of zone 1, and others not available to zone 1. The effect of substitutes on the preliminary demand curve is shown in Figure 4.5.

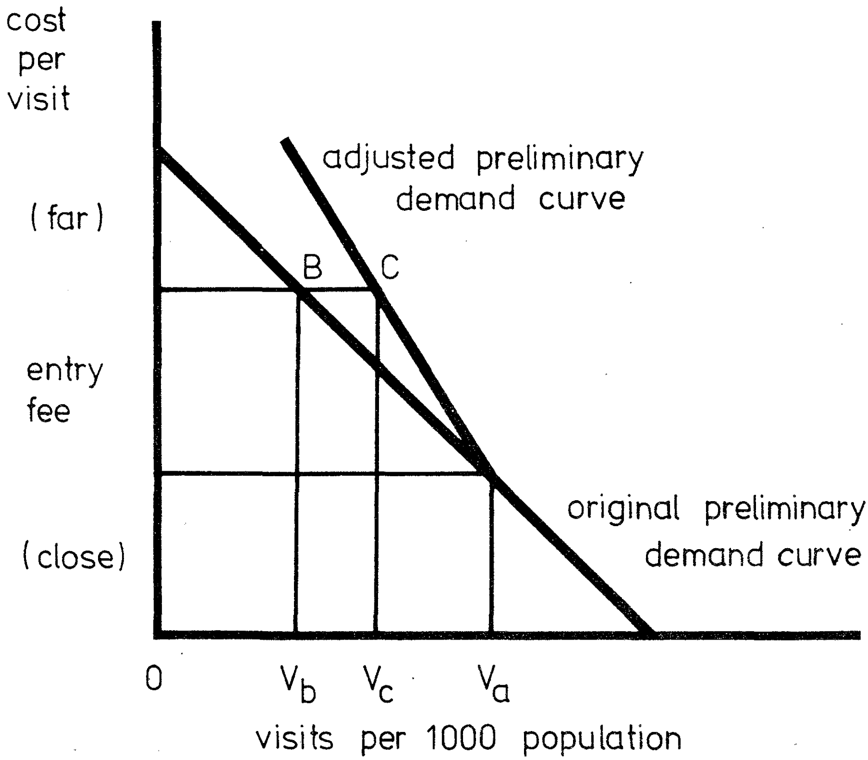


Figure 4.5: Effect of number of substitutes on the preliminary demand curve

If an entry fee is imposed, the cost for a visit from zone A increases to the cost for zone B. The visitation rate for zone A would be predicted to fall from V_a to V_b. But, zone A has less substitute sites available than zone B so the visitation rate will not fall this far, but to a level V_c. The original preliminary demand curve underestimates visits at increased entry fees. This is reflected in an outward movement of the final demand curve (Figure 4.6) for any positive price. The original demand curve (d_o,d_o)

underestimates consumers' surplus by the area between the two curves. This finding is not general. It would be possible to find cases, especially for unique activities, where the opposite case holds.

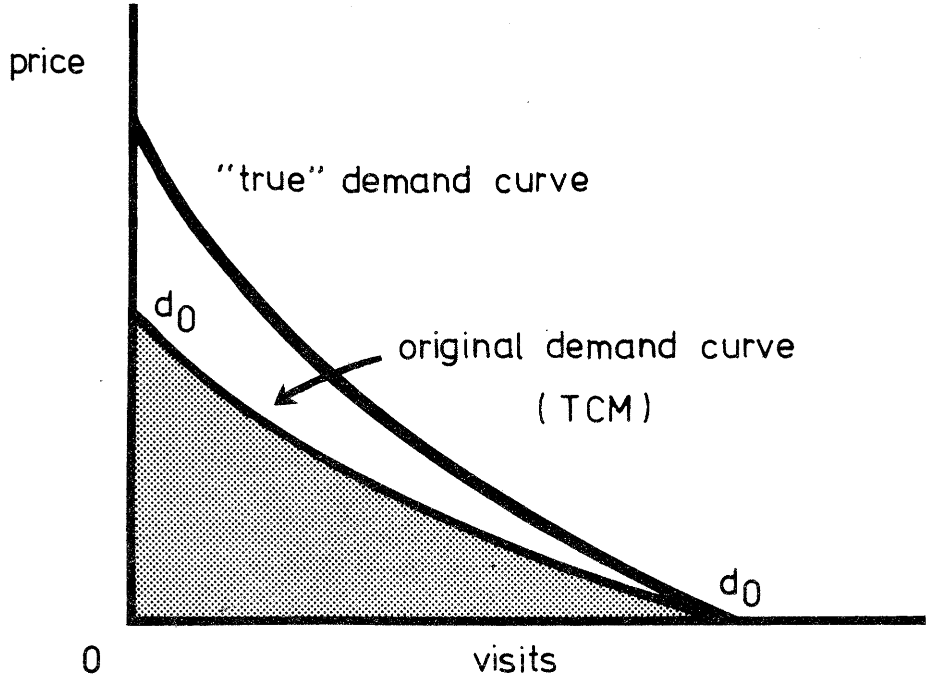


Figure 4.6: Effect of substitutes on final demand

4.3.2 Time Costs

The value of travel costs (TC_{ij}) used in equation 4.4. should include not only the out of pocket travel costs and on-site costs necessary for making the trip, but also the values of both travel and on-site time, which are opportunity costs of making a trip. Ulph and Reynolds (1981) provide the following justification. The price of a visit to a park (P_i) is:

$$P_i = C_s + Vt_s + M_jZ_j \quad \textbf{(4.5)}$$

where

C_s = on site costs;

V = the value of time;

t_s = time on site;

M_j = price of one unit of travel; and

Z_j = quantity of travel.

The value of one unit of time (V) is equal to its opportunity cost, which is the wage rate (W) plus the marginal utility of work (U_W).

Hence $$V = W + U_W \tag{4.6}$$

Define $$M_j = C_j + V + U_j \tag{4.7}$$

where

C_j = money cost of travel per unit of time; and

U_j = utility of travel.

By letting the amount of travel (measured in time) equal t and substituting 4.6 and 4.5 into 4.7, we have:

$$P_i = C_s + (W+U_W)t_s + C_jt_j + (W+U_j+U_W)t_j \tag{4.8}$$

Let the total of on-site and money travel costs be C_T, then:

$$C_T = C_s + C_jt_j \text{ ; and}$$

$$P_i = C_T + (W+U_W)t_s + (W+U_j+U_W)t_j \tag{4.9}$$

$$= C_T + \alpha t_s + \beta t_j \tag{4.10}$$

The values of C_T, t_s and t_j may all be observed. Ulph and Reynolds (1981, p.23) suggest that the values α and β may be estimated from actual behaviour. Equation 4.9 indicates that the value of time on site and time spent travelling will differ by the marginal utility of travel, necessitating that both time variables be measured.

Use of econometric techniques to estimate α and β in equation 4.10 is limited to the individual travel and costs method, as applied by Gum and Martin (1975) and Brown and Nawas (1973). Using aggregated data does not provide enough variabilility between observations of C_T, t_s, and t_j, which usually show a high degree of collinearity, precluding meaningful estimates of their associated coefficients.

If multicollinearity, or unavailability of individual data, precludes estimation of the time coefficients, an alternative solution is to use externally derived valuations of on-site and travel time. Much effort has been directed at valuing travel time (Cox, 1983), mainly in the context of urban commuting. Little effort has been directed at valuing on-site time, which has either been aggregated with travel time (McConnell, 1975) or, more commonly, ignored (Knetsch, 1963). Travel time has generally been valued at between twenty and eighty percent of the hourly wage rate (Cesario, 1976). It is possible that the marginal utilities of recreation and community travel are not identical, raising doubts as to the validity of applying these estimates to recreational travel.

If aggregate time costs ($\alpha t_s + \beta t_j$) are positively related to money travel costs, then the travel costs method will underestimate the number of visits at any positive entry fee, and so underestimate consumers' surplus attributable to the site, when time is excluded from the analysis. Figure 4.7 shows two preliminary demand curves: PD_T which includes aggregate time costs, and PD_N which excludes time costs.

The preliminary demand curve which excludes time (PD_N) underestimates the cost of any visit (P_i). Imagine the behaviour of residents of a zone facing money travel costs of $\bar{P}$ (total travel costs $\hat{P}$) and visiting at the rate V^0. If time costs are excluded, adding an entrance fee δ will bring about a new visitation rate V^1 at point C. However, adding an entrance fee δ to the time inclusive price of a visit at point B causes the visitation rate to fall only to V^2, at point D, since PD_T is relatively steeper than PD_N.

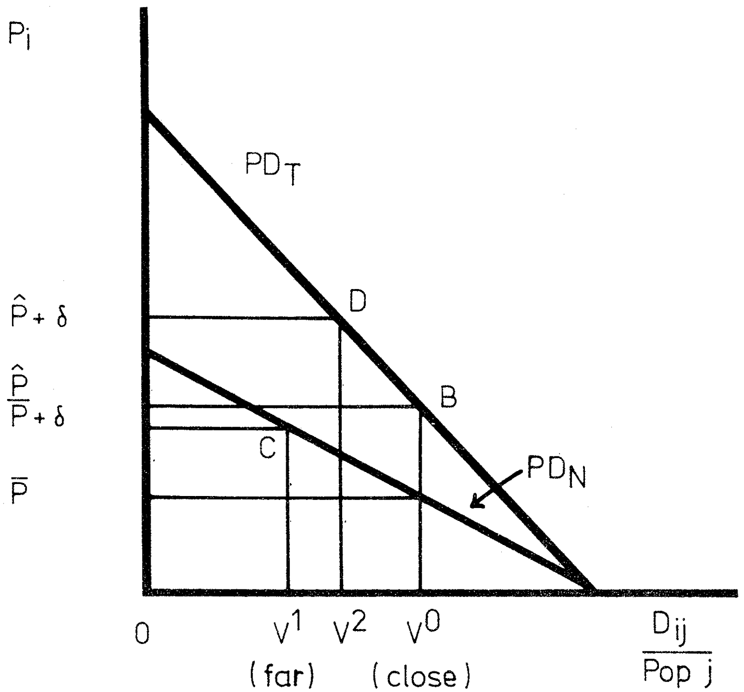


Figure 4.7: Effects of exclusion of travel and on-site time

The third assumption on which TCM rests raises further problems. Even if all costs are counted, it may be that people do not treat an increase in travel costs in the same way as an increase in an entry fee. Many believe we have a right of free entry to recreation sites and would protest an entrance fee, while readily accepting a rise in the price of petrol. This is an area in which experiments may be able to assist.

4.3.3 Multiple Destination Trips

The assumption of single destination trips does not pose a problem for many sites, such as recreational hunting areas, where a large proportion of users travel directly to and from the site for a specific purpose. However, this is certainly not true of visitors to Mount Cook National Park, the majority of whom are on a comprehensive holiday which is usually part of a tour of the South

Island, if not New Zealand, or indeed the world. Clearly, allocating the full return cost of a trip from a visitor's home to Mount Cook will overestimate visitation rates at any given travel cost.

The *a priori* effect on demand at costs above present levels is indeterminate. In general it is likely that visitors from more distant zones will visit more sites on a trip, while those living close to a site are more likely to make single destination trips. The effect of this is that travel costs are overestimated for visitors from distant zones by more (absolutely) than for travel costs of visitors from near zones. As entry fees are added (travel costs are increased), actual visitation rates fall further than predicted and so visits at added costs are overestimated.

Use of the marginal costs incurred in visiting a site (the difference in costs of making the same trip with and without visiting the site) is inappropriate to circumvent multiple-destination bias. A highly valued site may be only a short distance from another site and thereby be valued lowly, when the other site may not ever have been visited unless it was en route to the valuable site. Haspel and Johnson (982) suggest that there is no satisfactory theoretical basis for identifying a joint product's exclusive share of costs, indicating that an *ad hoc* solution will be necessary. Beardsley (1971) provides a method that is appropriate when travellers allocate time at destinations in proportion to the benefits of those destinations. The share of total trip costs allocated to site i is:

$$\frac{\text{Time at i}}{\text{Total trip time - travel time}} = \frac{\text{Time at i}}{\text{Time at all sites}}$$

Haspel and Johnson propose a method which divides travel costs equally between all trip destinations, but allows for some adjustment when a group of destinations are within close proximity. The values obtained by Haspel and Johnson using two alternative forms of their method were within fifteen percent of willingness to pay estimated from contingent willingness to drive. An alternative approach suggested by Ulph and Reynolds (1981) is to ask site visitors to rank, or score, sites for their importance on the trip and allocate costs accordingly.

A further practical limitation of the method is that it may not be possible to obtain sufficiently differentiated distance zones if most users live very close to the site in question. This is especially so in cases where a site is located within, or close to, a large city which provides the majority of users. In these cases the cost of travel to a site may be insignificant relative to other costs and the method may not be well suited to the valuation problem.

4.3.4 Change in Resource Quality

Stevens (1966) provides a method of applying the travel costs method to evaluate the effects of quality changes in a resource. Demand functions are found in the usual way, incorporating the quality variable (say visitors per unit area) as a predictor of demand. The quality variable may then be altered and a second demand curve reflecting the change in quality found. The value of this quality change is then equal to the difference in the levels of consumers' surplus associated with each demand schedule. A problem with Stevens' method is in providing the links between quality changes in the resource and changes in measurable characteristics. If these relationships are known, this method is still limited in that it can only be used to value changes within the range that has already been experienced.

4.4 Summary

The travel cost method is based on the general hypothesis that a visit to Mount Cook National Park will be taken if the benefits associated with the natural environment are at least equal to the costs associated with the visit. By sampling visitors to the Park we can derive an estimate of total benefit. Travel cost is assumed to be one of the main determinants of visitation. Other variables may be important, such as: income, the available of substitutes, multiple destination trips, and education. Value is attributable only to the natural resource and its potential visitors in their present states, which for the purpose of this study is Mount Cook National Park as it was throughout 1984 - the Park, the Village, congestion, the weather, as well as the tastes and incomes of all potential 1984 visitors.

5. Study Implementation

Once the specific data needs have been identified, the problem of collecting the data arises. The first three parts of this section are concerned with the sampling method used, the design of the questionnaire and the logistic aspects of "capturing" Park users. The final part considers response rates and particular problems encountered.

5.1 The Sample

The visitor survey was conducted throughout 1984. As it was not practical to consider sampling continuously over the full year the first consideration was to select sampling periods that were representative of different times of the year. A seasonal profile of visitor numbers was obtained as shown in Figure 1.5. Peak visitation rates occur in January. The high summer period extends from November through to the end of March. The low month for visitors is July. However, since winter visitation is heavily weather dependent, this does vary and the minimum month may occur from May to July.

The survey periods chosen were:

(1) 21 January - 17 February 1984
(2) 1 May - 7 May
(3) 9 July - 15 July
(4) 10 August - 16 August
(5) 12 November - 19 November
(6) 11 December - 17 December

These periods were selected to provide a representative sample of all visitors throughout the year. In order to avoid biasing the sample by over-representation of certain groups, account was taken of school and university holidays, long weekends, and times when specific activities might predominate. A total of nine weeks of the year were sampled.

Since there is only one road leading into Mount Cook National Park, obtaining a sample of visitors was simplified. Visitors also arrive by air, and a very small number walk over the Main Divide (most crossing the Main Divide do so from east to west). This latter group could not be sampled. A twenty percent sample of all visitors arriving by coach and by air was taken. For those arriving by other motor vehicles and bicycles, a twenty percent sample was taken between the hours of 9 am and 5 pm. A road counter was used to check the total number of vehicles entering the Park during the survey period, and to allow adjustment for incomplete daily sampling.

5.2 Questionnaire Design

Reliable data are necessary for survey analysis and therefore the design of the questionnaire is of prime importance. After initial development the questionnaire was tested in a pilot survey which resulted in changes being made to some of the questions. A brief coverage of the data requirements and related questions follows, while the questionnaire itself is included in Appendix B.

Visitor numbers were estimated from a systematic sample of vehicles entering the Park and recording the number of vehicle occupants on an "Interviewer Sheet" (see Appendix A). By recording this information separately, estimates of visitor numbers are free of response biases.

To meet the primary objective of this study it was important to obtain good information on travel, so questions providing travel data were placed at the beginning of the questionnaire. The travel cost method in its simplest form can be employed in cases where only the number of visitors from each origin zone and costs of travel are known. These data are provided by answers to questions one, two and three of Section I in the questionnaire (see Appendix B). By placing these simple, but valuable, questions early in the questionnaire, usable data could be obtained even if respondents did not complete all the questions.

Question four of Section I was included to allow determination of Park value for different categories of visitors. The question is an open one to allow respondents to specify the reason for their visit. It is possible that while not many people visit the Park for some specific purpose (for example, climbing or photography), the value of each visit to these users may be very high. This could have implications for Park management strategies.

Question five may help predict visitation. Many people are likely to visit the Park once, as part of a tour, or to see what is there. If they are impressed they may return; if not, it is probable that no return trips will be made. Groups of people making first visits and people making subsequent visits may therefore be dissimilar.

Overnight accommodation can be a substantial part of trip costs. Questions six and seven are useful for estimating these costs, as well as for providing data on length of stay at Mount Cook National Park. Some visitors to the Mount Cook area stay overnight at Glentanner Park, which is a short drive from the Park boundary, and make day trips to visit the Park. The marginal cost of a visit for these people is the cost of a trip from Glentanner, not the cost of a trip from their homes. These visitors are identified in question eight. The pilot survey indicated that some people were uncertain as to whether or not Glentanner was within Mount Cook National Park. This question also served to clarify the distinction.

It can be argued that the marginal cost of visiting Mount Cook National Park is the difference in travel cost with and without Mount Cook as a destination (Chapter 4). Further, multiple destination trips can bias results from the travel costs method. Data which allow the implementation of techniques to counter these two problems are provided by questions nine to thirteen of Section I.

The development of tourism multipliers from the input-output analysis discussed in Chapter 3 is dependent upon the identification of industries in which tourist expenditures are made, and the amount spent on each industry's output by tourists. These are likely to vary for visitors from differing origins, and for visitors with different purposes for visiting Mount Cook National Park. Therefore, a separate section requiring expenditure information is included in the questionnaire.

Expenditures on different types of goods at locations within the study area are provided by the table in Section II. This table is complete in that it covers all expenditures at all possible locations in the Mackenzie Basin. While the table may appear daunting at first glance, it is not likely to be difficult to complete. Most visitors only stop at two or three of the locations, and expenditures are often limited to petrol and an ice cream. These are not difficult to recall. By listing all destinations it is made clear to respondents which towns are included in the survey area. It is also possible to derive location specific multipliers if necessary. A map inside the front cover of the questionnaire reminds visitors of the locations of the towns listed. The only obvious difficulty with this question is that respondents are asked to list the amount they "expect to spend" as well as amounts actually spent. Since a number of overseas tourists in particular will spend another night in the Mackenzie Basin at Tekapo or Omarama, the expenditure data obtained may underestimate actual expenditures. However, additional information on accommodation and meal costs can be obtained from the answer to question ten, which asks where the next night will be spent.

A major survey of national park visitors allows the park administration the opportunity to address particular issues. The questions in Section III were provided by the ranger staff at Mount

Cook. They are not analysed in this report.

The questionnaire is coloured bright yellow to stand out amongst other papers that people may have in their vehicles. The front cover contains a space in the top right corner for an identification number which was recorded on the "Interview Sheet" (Appendix A) as the questionnaire was handed out, along with the time of day, type of vehicle and number of people in the vehicle. This was useful for identifying types of non-respondents, but since names or addresses were not requested, it could not be used to specifically identify or follow up non-respondents.

A letter from the investigators was included inside the first page of the questionnaire on a Centre for Resource Management letterhead to assure respondents of the authenticity and confidentiality of the study and to state its objectives. The back cover contains a map of the village area, showing sites for return of the questionnaire.

5.3 Sampling Practise

As mentioned earlier, a sample of visitors arriving over nine weeks of 1984 was taken. Visitors were divided into several groups: those arriving by private and rental motor vehicles, those travelling on tour buses, those travelling on the daily service bus and visitors arriving by aeroplane.

The necessity for stratifying visitors in this way arose from the practical problem of determining where to sample. There is no site within the Park where all visitors stop. This meant that vehicles had to be stopped on State Highway 80, the road in to Mount Cook National Park. The optimal site would have been between the Park boundary and the airport road turn-off, since there is a considerable amount of "local" traffic between the village and the airport. This consists of local residents, airport employees, and visitors establishing themselves in the village and then going to the airport for ski-plan flights. However, traffic travels very fast along the stretch of road just after the Park entrance and it would be difficult and possibly dangerous to stop vehicles there. The area is also very exposed, which would increase the problems for the people handing out questionnaires, particularly during the winter months.

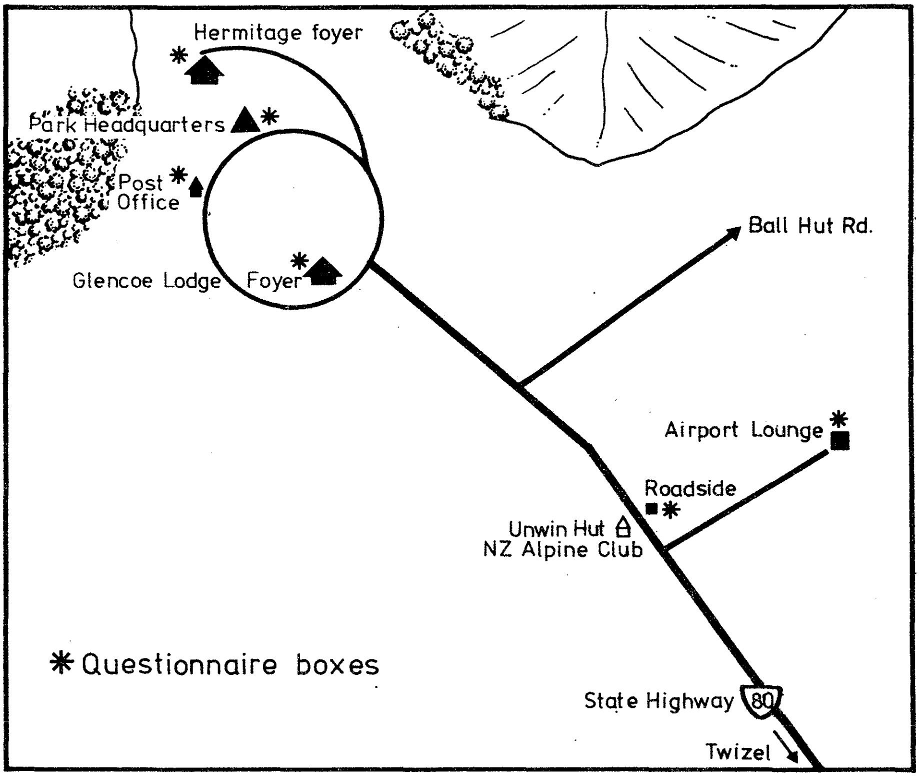


Figure 5.1: Survey point

It was therefore necessary to find a sampling point closer to Mount Cook Village. A suitable site was found outside Unwin Hut, the NZ Alpine Club base unit, situated one kilometre past the airport turn-off and four kilometres from Mount Cook Village. Unwin Hut was used to accommodate workers and could be used for shelter while awaiting the arrival of vehicles. The roadside verge was levelled and orange traffic cones were used to direct traffic off the road for safety. A curve in the road 400 metres before the survey point initially slowed traffic and a sign requesting vehicles to stop if requested, placed 300 metres before the survey point, further slowed traffic. During a pre-test of this system all vehicles requested to do so stopped, and so the technique was adopted. It was found that vehicles tended to arrive in groups, but that a sample rate of one in five vehicles (twenty percent) was manageable. A sampling rate of one in three or four may possibly have been manageable, but was not chosen since if at any stage the roadside workers could not handle this flow of vehicles the sampling ratio would be upset.

Once the survey point had been selected, grouping of types of visitors became necessary. It was not practical to consider stopping buses at the survey point without first notifying drivers of the possibility. Because of the large number of companies and drivers involved, it was decided that tour buses should be treated as a separate group. A daily service bus comes from Twizel. It is easily identifiable by time of day and type of bus. Since passengers travelling on this bus are likely to have different characteristics to those travelling by tour bus, this bus was considered separately. They travel from the airport to the village area by Mount Cook Company service buses which were excluded from the tour bus group. The final group consisted of all other vehicles and cyclists passing the survey point.

The sampling method was essentially the same for all visitor groups, although they were actually sampled at different places. A running counter was maintained from starting time in the morning (9 am) on the first day to finishing time in the evening (5 pm) on the last day.

Cars, motorcycles and cycles were stopped by the roadside, and their occupants given a questionnaire which they were asked to complete during their stay in the National Park. Often people stopped in this fashion were interested in the survey and would pause to ask a few questions about the survey and the area.

Questionnaires were distributed on a group basis. That is, one questionnaire was, given to each group sharing expenses in the vehicle. Typically, this meant one questionnaire per vehicle unless a car contained obviously separable groups, such as two couples or a hitch-hiker. A certain amount of expertise was developed in identifying groups. However, if there was any doubt, individual questionnaires were used. Since both the questionnaire and the interviewer sheet recorded number in group, it was possible to obtain per capita data at a later date. The interviewer sheet was used to check the response rate.

Aeroplane passengers were sampled at the airport. A visit to the airport each morning provided a list of expected flights and times. The running counter pinpointed each fifth flight and an interviewer would visit the airport just prior to the expected arrival. A sign was positioned on the airport fence indicating that a survey was in progress and passengers were stopped as they entered the airport enclosure. There were a number of problems associated with sampling aeroplane passengers. Firstly, passengers leaving an aircraft tend to have their arms full and are not readily able to hold an extra item. Secondly, they have just arrived in a totally new environment which they are very keen to observe. This made air travellers the most difficult group to survey.

Bus passengers generally proved easier than aeroplane passengers to sample. Initially it was hoped that the hotels at Mount Cook would be able to provide similar information to the airport with respect to expected bus arrivals. However, this did not prove to be the case. Actual arrival times varied considerably from expected times of arrival and even expected numbers of buses given were unreliable. A fairly successful method of bus sampling finally evolved. As each fifth bus passed the sample point, one interviewer would follow in a car. The interviewer would then board the bus before any passengers alighted and distribute the questionnaires. This distribution was managed in two ways, depending on the type of bus. For buses staying overnight in the village, individuals and obvious groups were given questionnaires. A number of tour buses visit the park for only a short period; typically, an hour for lunch. In most of these cases the interviewer would speak to the 'lunch bus' driver or courier and ask them to fill out one questionnaire on behalf of the entire group. Bus drivers claim to have a very good idea of their passengers' expenditures and were very helpful in this respect.

The scheduled buses from Twizel were treated similarly to tour buses. Each fifth day a bus was followed up to the village and in this case individual questionnaires were distributed.

The response from visitors to being stopped and given questionnaires was generally positive. Most people were courteous and apparently did not mind being stopped. This was particularly notable with respect to private and rental cars. However, as mentioned earlier, the attitude of aeroplane passengers was less amenable.

The travel costs of individuals depends on the numbers travelling together. The number of people in a vehicle (car, bus or aeroplane) was recorded on the interviewer sheet (Appendix A) at the time the questionnaire was distributed and was later matched to the completed questionnaire.

A Japanese version of the questionnaire was also produced. The number of visitors from other non-English speaking countries did not warrant the expense of questionnaires in other languages. Many of these people travelled in tour groups and the tour leader spoke English.

There were a number of logistical problems which affected the operation of the survey, some of which have already been mentioned. One recurrent problem concerned the positioning of the sample point. As has been noted, there is a considerable amount of 'local' traffic between the airport and the village. These vehicles should not be included in the sample. After a short time most local cars and buses could be identified by the interviewers and they were ignored in the running counter. If a local vehicle was stopped accidentally it was asked to proceed and the counter was reset to zero.

A further problem occurred during the July sample period. Unfortunately this co-incided with an aircraft accident in the National Park where three persons, including a Park employee, were killed. As a result, all ski-plane flights were cancelled, which meant that a number of skiers who would otherwise have visited the Park stayed away, and as well there was a considerable amount of additional traffic into the Park. The survey was suspended for several hours during this period.

5.4 Visitor Numbers

A road counter was installed near the Park boundary to give a check on vehicle numbers. For the initial (January-February) period this was a Ministry of Works machine which was able to indicate the time of day that traffic passed. This machine was later replaced by a simple axle counter belonging to the Park. A combination of road counter readings and interviewer sheet information allows the estimation of numbers of visitors arriving at Mount Cook by road (excluding those travelling by coach).

Over the period 21/1/84 - 17/2/74 (28 days) 4 758 vehicles entered Mount Cook National Park. Of this number 3 569 entered between the hours of 9 am and 5 pm, the hours the survey was in progress. Of these, 2 965 vehicles were visitors entering the Park for the first time. The average number of non-visitor vehicles was therefore

$$\frac{3\ 569 - 2\ 965}{28} = 21.6 \text{ per day}$$

Our own observations indicate there was an average of 12 regular non-visitor vehicles per day, as well as tour buses (10 to 15 in summer, 5 in winter), and traffic between Mount Cook Village and Glentanner Park (hardly any in summer, but over 20 vehicles on fine winter days when there is heliskiing). Since the road counter was changed after this summer interview period, it was necessary to estimate the numbers of visitors and local vehicles arriving at other survey times. As shown above, 22 non-visitor vehicles per day during survey hours would be a reasonable estimate, and was used throughout the year.

It was also necessary to estimate the proportion of vehicles arriving during survey hours. This was 75.0% during the January-February period, and since daylight hours and activities are similar, would be expected to be close to this figure for the November and December surveys. For the winter months (May through August) it was dark by 5 pm and there were few arrivals after this time - we estimate about 5% of total traffic.

Table 5.1 shows predictions of numbers of vehicles arriving in the park based on road counts, survey data, and the assumption of 22 non-visitor vehicles between 9 am and 5 pm each day throughout the year. Note that the estimate of 94% of vehicles arriving between 9 am and 5 pm in the winter months is close to our own estimate of 95%, and the estimate for all summer months is 74%.

From Table 5.1 it is readily ascertained that visitor vehicles represent about 78.6% [=(6 364/8 099) x 100] of all vehicles entering the Park. For the year 2/4/84 to 1/4/85 a total of 45 355 vehicles entered the Park. The 8 099 vehicles arriving while the survey was in progress represent 17.86% of this annual total. The survey covered 63 days out of 366 in the year, or 17.2%.

		Summer (Nov-Feb)	Winter (May-Aug)	Total (All weeks surveyed)
A.	Number of vehicles entering MCNP (all hours)	6 587	1 512	8 099
B.	Number of visitors vehicles (9 am - 5 pm)	3 960	965	4 925
C.	Number of non-visitor vehicles (9 am - 5 pm)	924	462	1 386
D.	Percentage of all vehicles arriving (9 am - 5 pm)	74.1	94.4	77.9
E.	Number of vehicles arriving (5 pm - 9 am)	1 703	85	1 788
F.	Visitors as a percentage of all vehicles arriving (9 am - 5 pm)	81.1	67.6	78.0
G.	Total number of visitor vehicles (A x F) or $(B \times \frac{100}{D})$	5 342	1 022	6 364

Table 5.1: Estimates of vehicle numbers

Line G of Table 5.1 is estimated on the assumption that numbers of visitor vehicles are a fixed proportion of all vehicles arriving in the park, irrespective of time of day.

We are now in a position to estimate annual visitors to Mount Cook National Park by road (excluding coach passengers). There are two approaches:

▲ Interviewer sheet data provides an estimate of the mean number of passengers per vehicle. This was 2.41 adults and 0.37 children. Total yearly vehicles was 45 355, of which about 78.6% (35 649) were visitors to Mount Cook. Therefore, estimates of annual visitor numbers by this mode of transport are:

Adults	2.41 x 35 649 ≃	86 000
Children	0.37 x 35 649 ≃	13 000
		99 000

▲ The survey period (9 am - 5 pm) covered 77.9% of all vehicles arriving on all days surveyed, while total vehicles on the days surveyed consisted of 17.86% of the overall annual total. One in five vehicles was sampled, yielding a sample of 2 204 adults.

We would therefore expect approximately

$$2\,204 \times 5 \times \frac{100}{77.9} \times \frac{100}{17.86} \simeq 79\,000 \text{ adult visits/year}$$

$$325 \times 35.94 \simeq 12\,000 \text{ child visits/year}$$

The difference between the two predicted values of annual visits is a result of errors in the predicted numbers of vehicles arriving during the survey period.

Since an accurate count could be maintained on all aircraft and coaches entering the Park, a sampling rate of 20% was maintained. Sixty-three out of 366 days in the year were sampled. Estimates of annual visits for coach and air travellers are found by multiplying the sample size by 29.05% (5 x 366/63). These estimates are presented in Table 5.2.

Mode	Annual visits by adults	Annual visits by children
Road (excluding coaches)	79 000 - 86 000	12 000 - 13 000
Tour coach	50 000	6 000
Scheduled coach	6 400	650
Air	31 000	900
Total	170 000	20 000

Table 5.2: Estimates of annual visits by mode of transport

A check on total visits is provided by National Park Headquarters door-count figures for the year April 1982 - March 1983 of 127 390 individuals (Slater, *pers. comm.*). Question 2 of section III in this survey indicates that 71.5% of adult visitors to the park visit Park Headquarters. With 170 000 adult Park visitors, approximately 122 000 visits would be made to Park Headquarters. The difference (7 400 visits) could easily be accounted for by yearly differences in visitor numbers, duplicate visits by individuals, or visits by children, lending credence to an estimate of total Park visitor numbers.

6. Regional Analysis

Methods for assessing the economic effects of visitor expenditures on regional economies were discussed in Chapter 3. We concluded that a regional I-O model would provide useful information on secondary benefits. In this chapter we develop an I-O model for the study area (Figure 6.1). Using this model we derive the multipliers associated with expenditures by visitors to Mount Cook National Park.

6.1 Regional Input-Output Tables

To estimate the effects of final demand changes on the local economy it is necessary to obtain a transactions matrix for that economy. The Department of Statistics publishes such tables only for the nation as a whole. The local economy being studied is usually considerably different from a scaled down version of the national economy. Some industries, in which the local area specialises, will be over-represented, such as the coal mining industry on the South Island's West Coast, while other industries will be under-represented, or missing.

The nation probably produces a much wider range of products than the region. Because of this, the regional economy will be more open than the national economy, requiring imports from other regions of goods not produced locally (or not produced in sufficient amounts to satisfy demand). Goods in which production is specialised will be exported to other regions. Similarly the product mix of local members of an industry is likely to differ (probably be less diverse)

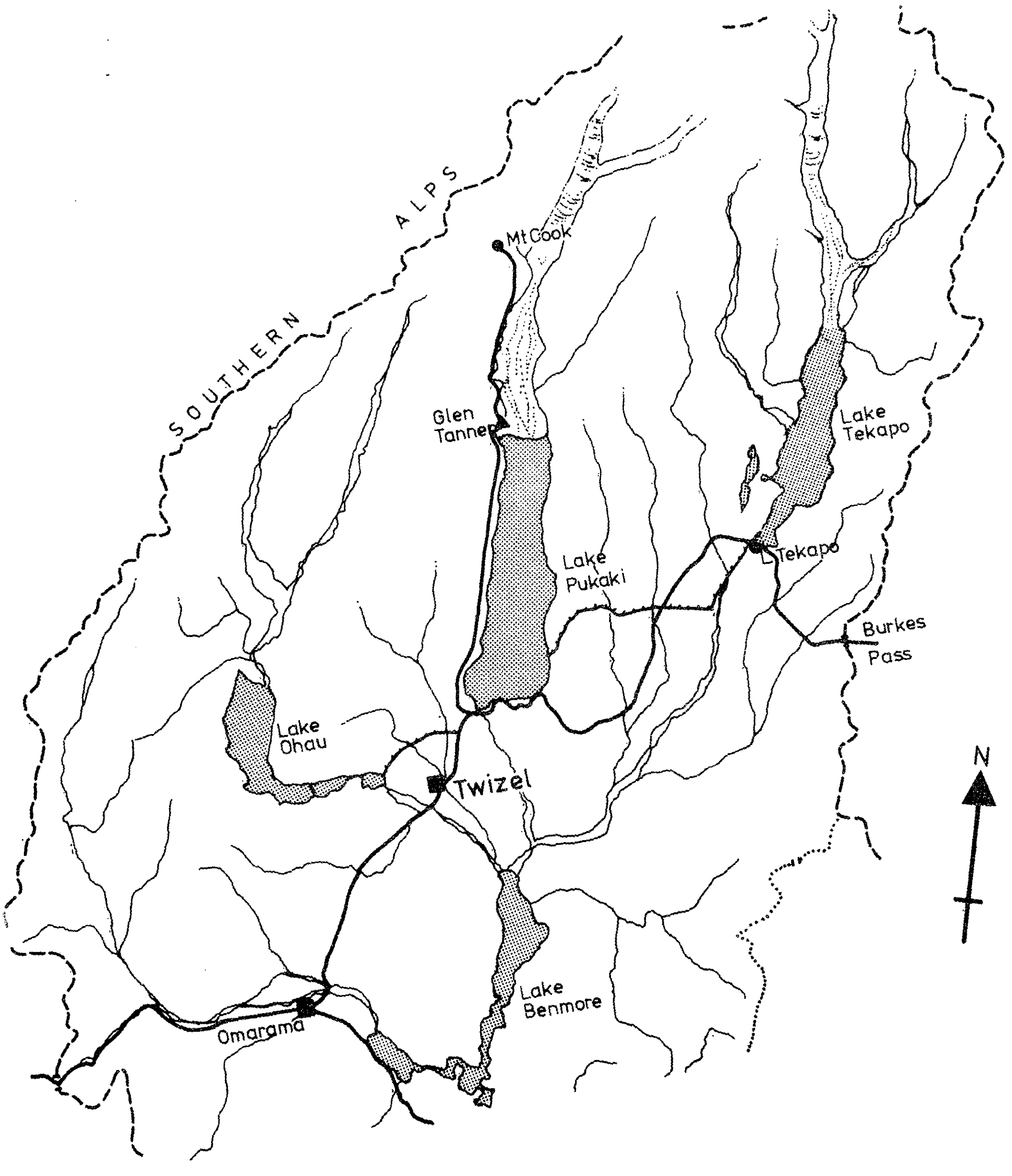


Figure 6.1: The study area

from the national industry. Unless all industry outputs require the same mix and proportions of inputs, the local coefficients will differ from the national ones. For these reasons it is not satisfactory to use unadjusted national tables.

Ideally a regional table should be constructed in the same manner as the national table - by a census and survey of industries operating in the local economy. This procedure is beyond the scope of most regional studies as it entails high costs and huge data handling problems. In addition, Pearce (1982) found businesses reluctant to reveal financial information. The problems encountered and procedures required to produce an I-O matrix are covered well in Richardson (1972). That the New Zealand national I-O tables for the 1976-77 year (Department of Statistics, 1983) were not published until September 1983 is an indication of the volume of work required to produce a survey-based I-O table. Compilation of a regional I-O table from primary data was certainly beyond the resources available for this study.

Several procedures for developing I-O tables from non-survey data are available (Richardson, 1972, Chap.6). Most of these procedures develop regional coefficients by adjustment of national coefficients. Regional coefficients will often be smaller than national coefficients because of the increased import requirements. The effects of differing industry compositions are not known *a priori*.

Following Hubbard and Brown (1979, 1981) the Simple Location Quotient (SLQ) technique has been chosen as an accurate but inexpensive method for generating a regional I-O table for this study. Hubbard and Brown (1981; p.18) provide some evidence that the SLQ technique is one of the more successful non-survey methods for generating regional input-output tables, and use it to develop tables for the thirteen statistical areas within New Zealand. In the work they have closely followed the GRIT method (Generating Regional I-O Tables) developed at the University of Queensland by Jensen *et al.* (1979).

6.2 GRIT Method

The GRIT method assumes that the regional composition of each industry is the same as the national composition, requiring the same mix of inputs. The regional A matrix coefficients are now necessarily no larger than the national coefficients.

Let technical I-O coefficients be designated C_{ij}, and be defined as the number of units of input from industry i to produce one unit of gross output in industry j. Inputs of i can come from either local sources (A_{ij}) or imports (r_{ij}).

Then we have: $$C_{ij} = a_{ij} + r_{ij} \tag{6.1}$$

These coefficients may be measured in dollars so it is possible to aggregate the import coefficients and obtain the total value of imports required for one dollar of output from any industry j, (r_j).

$$r_j = \sum_{i=1}^{n} r_{ij} \tag{6.2}$$

The import coefficients (r's) are usually entered as a single row of the primary inputs sector of the I-O matrix.

The coefficients matrix for a three industry national economy (ignoring other primary inputs and final demands) is represented in Figure 6.2.

$$
\begin{bmatrix}
\frac{1}{2}a_{11} & \frac{1}{2}a_{12} & \frac{1}{2}a_{13} \\
a_{21} & a_{22} & a_{23} \\
a_{31} & a_{32} & a_{33} \\
 & & \\
r_1+\frac{1}{2}a_{11} & r_2+\frac{1}{2}a_{12} & r_3+\frac{1}{2}a_{13}
\end{bmatrix}
$$

Figure 6.2: Coefficients matrix

If, in our regional economy, industry 1 is only half as large in proportion to the rest of the economy as it is in the national economy, it will only be able to supply half of the inputs required by other sectors, ie. $\frac{1}{2}a_{11}$, $\frac{1}{2}a_{12}$, $\frac{1}{2}a_{13}$. The remaining inputs must be made up with imports. The coefficients matrix must be altered, as in Figure 6.3.

$$
\begin{array}{l}
\text{Industry 1} \\
\text{Industry 2} \\
\text{Industry 3} \\
\\
\text{Imports}
\end{array}
\begin{bmatrix}
a_{11} & a_{12} & a_{13} \\
a_{21} & a_{22} & a_{23} \\
a_{31} & a_{32} & a_{33} \\
 & & \\
r_1 & r_2 & r_3
\end{bmatrix}
$$

Figure 6.3: Revised matrix

This adjustment must be completed for each industry. Where LQ is the relative size of the local industry (LQ<1) we have

$$a_{ij}^{R} = LQ_i \, a_{ij}^{N} \quad \textbf{(6.3)}$$

(the R and N superscripts indicate regional and national coefficients respectively) and

$$r_j^{R} = r_j^{N} + \sum_{i=1}^{N} (1-LQ_i) \, a_{ij}^{N} \quad \textbf{(6.4)}$$

If LQ>1, the local industry can satisfy the input demands of all local industries for its output, so

$$a_{ij}^{R} = a_{ij}^{N} \text{ and } r_{ij}^{R} = r_{ij}^{N}$$

If LQ<1, then equations (6.3) and (6.4) apply, and should be used to provide new regional coefficients.

By adjusting the national table in this way it is possible to derive a full regional table. All that is necessary is an estimate of the LQ's, also known as *Location Quotients*.

There are a number of possibilities for measuring industry size, the two most common being value of output and number of workers employed. In most cases, the latter is the most easily obtained information and so we have:

$$LQ_i = \frac{E_i^{R}/E^{R}}{E_i^{N}/E^{N}} \quad \textbf{(6.5)}$$

where

E_i^j = employment in industry i, in economy j; and

E^j = total employment in economy j.

The method described so far assumes that regional imports from foreign countries, by industry, are identical to national imports. Jensen *et al.* (1979, p.58) claim this assumption is untenable, allocating imports to local industries on a pro-rata basis, and entering all import coefficients as zero. This provides estimates of industry technical coefficients, and shows what local production would be necessary to satisfy the same set of final demands in an economy closed to imports. Jensen *et al.* suggest superior knowledge should be used in assessing which industries should be allocated imports. In New Zealand published data provide this information.

The GRIT procedure relies on the assumption that the need of other industries for output from industry i, as a fraction of total output, is the same locally as nationally. Richardson (1972, p.120) provides a method (the purchases only LQ method) designed to reduce the distortions created by the SLQ method. This does not eliminate the problem altogether and provides only slightly superior estimates of coefficients when compared with SLQ.

The GRIT method assumes that intra-regional transactions have the same relative importance locally as nationally. However, as the region shrinks, many intra-regional transactions become inter-regional, and so the GRIT method overestimates intra-regional trade. This results in overestimation of multipliers, as the true a_{ij}'s are smaller than those estimated.

Hubbard and Brown (1981, p.22) indicate that as the national I-O table is aggregated the location quotients will tend to unity. With aggregation some inter-industry trade becomes intra-industry, making industries appear more self-sufficient. This results in the over-estimation of multipliers from the regional table.

Having developed the regional coefficients it is then necessary to multiply them by the relevant regional industry outputs to estimate the local transactions matrix. Regional outputs may be available, but if not, may be estimated as a proportion of national output, based on employment levels in each industry at the national and local levels. Subtracting inter-industry transactions from total output leaves final demand as the residual. Local categories of final demand (household consumption, inventory buildup, government spending) may be known or estimated on proportionate bases. Exports are the difference between total final demand and local demand.

Enough information is now available to estimate the entire I-O model of the local economy. The model may be improved at many stages of its development by the addition of superior data. This may be the updating of national tables to reflect changes in relative prices.

Further opportunities exist in estimating local outputs and consumption, or estimation of transactions in major industries, and local industries requiring different input mixes to their national counterparts, by surveys or "expert knowledge".

The expense of deriving survey based regional I-O tables cannot usually be warranted, and scaled national tables are not valid. The GRIT method for adjusting national tables provides a cheap and relatively simple procedure for deriving regional tables. The method claims only "usable" accuracy, being known to provide overestimated multipliers, and so is a compromise solution between expense and accuracy. The extent to which superior information is added during the procedure is directly related to the accuracy of results, allowing some margin of choice in the cost/accuracy trade-offs.

6.3 Applying GRIT

In order to apply the GRIT method it is necessary to identify the number of industries existing in the local economy and the degree to which these can be aggregated. The national I-O table may then be aggregated and imports allocated accordingly. Industry outputs for local industries, and final demands for the outputs of local industries, must be estimated.

6.3.1 Local Industries

At the 1981 census the study area contained 2 454 full-time members of the workforce. Of these, 1 728 lived in Twizel township, the construction town for the Upper Waitaki hydro-electric power scheme. As this scheme was due for completion in mid-1985 it is important that any changes taking place in the Twizel community since the 1981 census be considered in construction of the local I-O model. The breakdown of employment by industry at the 1981 census for the study area excluding Twizel, and for Twizel separately, is shown in Table 6.1. Clearly, any change in Twizel could have far-reaching effects on the make-up of local industry. Table 6.1 highlights a further problem in applying GRIT using industrial employment location quotients to a small local economy in New Zealand. The Department of

Industry		Number employed in study area excluding Twizel	Number employed in Twizel	Total
1	Agriculture	216	12	225
2	Fishing, hunting	9	0	12
3	Forestry, logging	6	0	6
4	Mining, quarrying	3	0	0
5	Food, beverages, tobacco	0	3	0
6	Textiles, apparel, leather	0	0	0
7	Wood, Wood Prods, furniture	3	0	3
8	Paper Paint Publishing	3	0	3
9	Chemical, Petrol etc	3	3	6
10	Non-metallic minerals	3	3	6
11	Metal industries	3	0	3
12	Fabricating metal/ machinery	9	9	18
13	Other manufacturing	0	0	0
14	Electricity, gas, water	30	75	105
15	Construction	57	1 266	1 326
16	Trade, restaurants, hotels	231	132	360
17	Transport, storage	30	33	63
18	Communications	6	15	21
19	Financing, Insurances etc	6	15	21
20	Owner-occupied dwellings	0	0	0
21	Community, Social & Personal Services	90	120	210
22	Central Government Services	18	42	60
23	Local Government Services	3	0	3
Total		720	1 728	2 454

Source: Department of Statistics (unpublished data)

Note: Department of Statistics figures are rounded to one of the two closest multiples of three to retain confidentiality.

Table 6.1: Full-time employment by industry, 1981 Census

Statistics' practice of rounding employment figures to one of the two closest multiples of three, means that for small industries there is the potential for large errors in location quotients. For example, if two people are employed in a local industry, this may be reported as zero or three. The location quoitent so derived could be zero, or alternatively it could be 50% greater than its true value. By aggregating industries it is possible to reduce the errors in location quotients substantially. The manufacturing industries 7 to 12 of Table 6.1 can reasonably be combined to form one "manufacturing" industry. Similarly, communications is aggregated with finance, and the three service industries (21-23) are combined to form a single "service" industry. As much tourist spending is concentrated on the retail, accommodation and restaurant areas, it was felt appropriate to break industry 16 into two divisions: (i) wholesale, retail, and restaurants; and (ii) hotels, accommodation, etc. The revised breakdown of industries is reported in Table 6.2.

Total employment by industry is the relevant figure for use in GRIT. It is assumed that no major changes have taken place in the economy outside of Twizel since the 1981 census and so the employment data for the area from Table 6.2 will be used, except where superior information is available. The changing nature of Twizel requires that all employment data comes from superior sources.

Ideally it would be preferred to use employment figures for Twizel after the construction force has left the town and it has attained some form of steady state. Unfortunately no-one is able to predict accurately what the steady state may be. As of November 1984, the Ministry of Works and Development (MWD) workforce in Twizel, which was mostly employed in the construction industry, had diminished to 184. The Ministry of Energy operating staff level had been set at 57 people, although whether these people would reside in Twizel or Omarama had not been fully resolved. This is irrelevant as both towns are within the study area.

Industry		Number employed in study area excluding Twizel	Number employed in Twizel	Total
1	Agriculture	216	12	225
2	Fishing, hunting	9	0	12
3	Forestry	6	0	6
4	Mining, quarrying	3	0	0
5	Food	0	3	0
6	Textiles	0	0	0
7	Manufacturing	15	15	30
8	Other manufacturing	0	0	0
9	Electricity	30	75	105
10	Construction	57	1 266	1 326
11	Wholesale, retail, restaurants	33	84	117
12	Hotels, accommodation	198	48	243
13	Transport	30	33	63
14	Commerce	12	30	42
15	Owner-occupied dwellings	0	0	0
16	Services	108	162	273
Total		720	1 728	2 454

Table 6.2: Full-time employment by industry, 1981 Census

Many businesses in Twizel had recently changed hands, and some new ones had recently started (auto-electrician, bakery, etc). Most business owners felt that their businesses would remain viable even after the departure of remaining MWD staff (Twizel Development Incorporated, *pers. comm.*). As such it was decided to use a profile of industries, excluding MWD staff, in Twizel as at December 1984 to represent the short-run steady state economy.

Twizel Development Incorporated (TDI), the successor of the local community council, was most helpful in convening a special meeting with a representative of the study team to compile a list of local industries and numbers employed by each. Nearly all residents were known personally by members of TDI and consequently great confidence can be placed on these estimates.

Because the latest national I-O tables published are for the 1976-77 year, employment figures representing national industry outputs have been obtained from the 1976 census. These figures, along with employment by industry and location quoitents, are presented in Table 6.3. The confidence limits on numbers employed in the Mackenzie Basin excluding Twizel arise because two printouts of rounded estimates were available, reducing errors in some cases. The number employed in industry 3 (forestry) was confirmed by NZ Forest Service staff at Omarama and Geraldine (Williamson, *pers. comm.*). No trace could be found of industries 4,6 or 8 (mining, textiles, other manufacturing).

Local quotients in Table 6.3 marked * are unambiguously greater than one. Error in their estimation is irrelevant since these location quotients will be set equal to one to signify that local production can supply local industry demand. In fives cases (Industries 7,10, 11,13,14) there is uncertainty associated with local quotients. In industry 7 the uncertainty is in the order of 10% but, since industry 7 is relatively small in the economy (2% of employment), it is unlikely to affect results significantly. For the other industries the confidence interval is in the order of ±5% of the mean location quotient.

Industry	Full-time workforce					
	Mackenzie excluding Twizel	Twizel	Total Mackenzie	NZ (1976 census) quotient	Expected location	Location quotient confidence limits
1 Agriculture	216 + 2	12	228 + 2	117 053	2.277*	[2.246,2.308]
2 Hunting	11 + 2	1	12 + 2	4 013	3.497*	[2.899,4.097]
3 Forestry	6	0	6	7 834	0.895	[0.895,0.895]
4 Mining	0	0	0	5 059	0	0
5 Food	0	6	6	68 787	0.012	[0.102,0.102]
6 Textiles	0	0	0	48 368	0	0
7 Manufacturing	15 + 2	4	19 + 2	183 552	0.121	[0.108,0.134]
8 Other manufacturing	0	0	0	5 017	0	0
9 Electricity	31 + 1	58	89 + 1	15 329	6.787*	[6.679,6.896]
10 Construction	58 + 2	13	71 + 2	112 137	0.740	[0.716,0.765]
11 Retail	33 + 2	33	66 + 2	210 951	0.366	[0.353,0.379]
12 Hotels	198 + 2	45	243 + 2	5 171	54.935*	[54.22,55.65]
13 Transport	30 + 2	7	37 + 2	76 684	0.564	[0.531,0.597]
14 Finance	12 + 2	20	32 + 2	114 395	0.327	[0.305,0.349]
15 Homes	0	0	0	0	0	0
16 Services	108 + 2	122	230 + 2	262 451	1.025*	[1.011,1.038]
Total	717 + 5	341	1 058 + 5	1 236 801	0	0

Table 6.3: Derivation of location quotients

6.3.2 Owner-occupied Housing Industry

It should be noted from Table 6.3 that no location quotient is estimated for industry 15 (owner-occupied housing). This is because the industry does not actually employ anyone, although it does require inputs from other industries and satisfies final demands of households, but not for other industries. In other words, the row coefficients are zero but the column coefficients may be greater than zero. The industry does not actually employ anyone because it is simply the housing services supplied to people living in their own houses. It is necessary to include it in the analysis since changes in demand for other goods will influence the demand for owner-occupied homes and hence the flow of inputs to build them as indicated by the non-zero column coefficients. Column coefficients are retained unchanged since industries are homogeneous across regions, leaving only the problem of estimating regional final demand by households for owner-occupied housing.

Assuming that owner-occupied homes in the study area are of the same mean value as for the country as a whole allows estimation of final demand by households for output of this industry (D_{15}).

$$D_{15} = \frac{\text{Number of owner-occupied homes in survey area}}{\text{Number of owner-occupied homes in NZ}}$$

$$\times \text{ National household final demand for owner-occupied housing}$$

For a sample containing nearly all the study area[1], census data revealed that 52.3% of dwellings are owner-occupied and the mean occupancy rate for all dwellings, excluding hostels and so on, is 2.602 persons. This indicates 768 owner-occupied dwellings within the study area, which has a population of about 3 823 people. At the 1976 census there were 642 797 owner-occupied homes in New Zealand, with a total value of $767 million.

---

[1]Data are published in such a way that boundaries are not exactly the same as for the survey area.

$$D_{15} = \frac{768}{642\ 797} \times \$767 \text{ million (1976/77)}$$

$$= \$917\ 000$$

6.3.3 Estimating Household Final Demands

Household final demands for industries other than owner-occupied housing are estimated by assuming homogeneous household consumption across regions, and thereby simply multiplying national per capita demand for the output of each industry by the local population size, ie.

$$D_i = \frac{N_i P_R}{P_N}$$

where

D_i = local final household demand for output of industry i;
N_i = national final household demand for output of industry i;
P_R = population of the region = 3 823 (1984 estimate); and
P_N = population of New Zealand = 3 103 265 (1976 census).

Alloction of output between households and other final demands, once inter-industry requirements are met, are estimated in two ways:

- D_i is multiplied by the location quotient for industry i and the residual is other final demands; or alternatively
- If total final demand is greater than D_i, D_i is supplied and others is the residual.

If total final demand is less than D_i, D_i is adjusted to equal total final demand, the difference is made up by imports and others is set to zero. The second approach is more consistent with the idea of satisfying local demands before any others, as occurs in other areas of GRIT, but is more likely to overestimate household final demand satisfied by local industries, and hence multipliers.

6.3.4 Agriculture Industry

Agriculture in the Mackenzie Basin consists of extensive grazing of sheep, primarily for wool production, with some cattle. Outputs of the industry are sold outside the area and must be processed before being re-imported to be consumed locally. No processing industries exist in the Mackenzie Basin. It is therefore necessary to set all row coefficients for industry one to zero and allocate them to imports. Perhaps the only exception here would be in the local sales of stock between members of the industry. However, this is small in relation to total sales so can safely be ignored (Whitby, 1979). All outputs of the industry are therefore allocated to exports.

6.4 Running GRIT

The GRIT model developed by Jensen *et al.* (1979) was used for generating local input-output models in this study. As previously mentioned, two methods are available for allocating final demands. The owner-occupied housing industry (industry 15) caused the model to blow up as no-one is employed, yet total outputs are non-zero. Output per person is therefore infinite. The industry cannot be dropped from the model even though Mount Cook National Park visitors do not purchase any of its output, since it still contributes to multipliers through induced spending. Alternatives are to aggregate the industry with another to prevent dividing by zero, or to allocate an arbitrarily small number of employees to the industry. The second approach will allocate small increases in direct employment to any changes of output of this industry, so will tend to bias multipliers upwards. However, this effect will be very small if the number of employees allocated is small. The GRIT model was run using both methods of allocating final demands, and both approaches to dealing with industry 15. In the aggregation cases, industries 15 and 16 have been combined. Industry 15 is the owner-occupied housing services industry. Multipliers obtained for the four cases are presented in Tables 6.4 to 6.7.

The abbreviations used are:

DIC	Direct income multiplier
EC	Direct employment multiplier x 10^3
DIIC	Direct plus indirect income multiplier
DIEC	Direct plus indirect employment multiplier x 10^3
T1OM	Type one output multiplier
T1IM	Type one income multiplier
T1EM	Type one employment multiplier
DIIIC	Direct, indirect plus induced income multiplier
DIIEC	Direct, indirect plus induced employment multiplier x10^3
T2OM	Type two output multiplier
T2IM	Type two income multiplier
T2EM	Type two employment multiplier

Comparing the multipliers from these four cases reveals very similar values. The assumptions are not critical considering that coefficients can only be close estimates at best. As long as this is borne in mind it is appropriate to select any of these models for further analysis. As industry 16 is a major area for tourist spending it is preferable not to aggregate this sector if possible. While it is certain that allocating as much final demand from households to local producers will overestimate multipliers, no such assertion can be made for the location quotient method of allocating final demand. For these reasons the multipliers of Table 6.7 will be used for further analysis of visitor impact.

It is useful to compare the multipliers obtained here with those obtained elsewhere. Roberts (1982) reports the following type one multipliers for tourism in New Zealand.

	Type one employment multiplier	Type one income multiplier
Foreign Tourism	1.40	1.61
Domestic Tourism	1.41	1.75

Industry	Multipliers											
	DIC	EC	DIIC	DIEC	T1OM	T1IM	T1EM	DIIIC	DIIEC	T2OM	T2IM	T2EM
1	0.09419	0.04200	0.12743	0.04657	1.10096	1.35288	1.10879	0.26205	0.05011	1.17330	2.78212	1.19312
2	0.26923	0.07546	0.30537	0.08092	1.11206	1.13423	1.07219	0.62798	0.08941	1.28540	2.44248	1.18464
3	0.26291	0.03571	0.35014	0.04773	1.29786	1.33179	1.33649	0.72005	0.05746	1.49661	2.73875	1.60897
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.15448	0.02020	0.18090	0.02434	1.09384	1.17100	1.20463	0.37201	0.02936	1.19652	2.40810	1.45350
6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
7	0.20153	0.02162	0.24134	0.02747	1.15238	1.19752	1.27085	0.49631	0.03418	1.28937	2.46263	1.58116
8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
9	0.16639	0.04457	0.27817	0.07139	1.60223	1.67175	1.60182	0.57204	0.07912	1.76014	3.43785	1.77529
10	0.18471	0.03793	0.24304	0.04764	1.25014	1.31577	1.25611	0.49979	0.05440	1.38810	2.70580	1.43420
11	0.28257	0.05331	0.33366	0.06055	1.15704	1.18077	1.13582	0.68614	0.06983	1.34643	2.42818	1.30977
12	0.24128	0.01398	0.29201	0.02200	1.17442	1.21026	1.57441	0.60050	0.03012	1.34018	2.48884	2.15510
13	0.31855	0.04129	0.38156	0.04979	1.20194	1.19780	1.20584	0.78466	0.06040	0.41853	1.46320	1.46264
14	0.33184	0.04438	0.37429	0.05017	1.13107	1.12792	1.13036	0.76971	0.06057	1.34353	2.31951	1.36474
15	0.54238	0.06002	0.59335	0.06713	1.15960	1.09397	1.11841	1.22019	0.08362	1.49641	2.24968	1.39316

Note: a) Industries 15 and 16 aggregated

b) Household final demand = National Household final demand x LQ_i

c) Employment multipliers for 1976/77 dollars

Table 6.4: Regional multipliers by industry

Industry	Multipliers											
	DIC	EC	DIIC	DIEC	T1OM	T1IM	T1EM	DIIIC	DIIEC	T2OM	T2IM	T2EM
1	0.09419	0.04200	0.16007	0.05849	1.38295	1.69940	1.39278	0.32345	0.06279	1.46979	3.43398	1.49517
2	0.26923	0.07547	0.30537	0.08092	1.11206	1.13423	1.07219	0.61706	0.08912	1.27763	2.29195	1.18088
3	0.26291	0.03571	0.35014	0.04773	1.29786	1.33179	1.33649	0.70753	0.05714	1.48771	2.69116	1.59986
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.15448	0.02020	0.18090	0.02434	1.09384	1.17101	1.20464	0.36555	0.02920	1.19193	2.36636	1.44519
6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
7	0.20153	0.02162	0.24134	0.02747	1.15239	1.19753	1.27087	0.48768	0.03395	1.28325	2.41986	1.57081
8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
9	0.16639	0.04457	0.27817	0.07139	1.60225	1.67177	1.60183	0.56211	0.07886	1.75308	3.37815	1.76950
10	0.18471	0.03793	0.24304	0.04764	1.25015	1.31578	1.25612	0.49111	0.05417	1.38193	2.65881	1.42826
11	0.28257	0.05331	0.33366	0.06055	1.15708	1.18080	1.13585	0.67423	0.06952	1.33799	2.38604	1.30398
12	0.24128	0.01398	0.29333	0.02220	1.18137	1.21573	1.58867	0.59273	0.03008	1.34042	2.45664	2.15248
13	0.31855	0.04129	0.38157	0.04980	1.20199	1.19783	1.20588	0.77104	0.06005	1.40888	2.42046	1.45410
14	0.33184	0.04438	0.37430	0.05017	1.13112	1.12795	1.13040	0.75635	0.06023	1.33407	2.27926	1.35695
15	0.54238	0.06002	0.59336	0.06713	1.15965	1.09398	1.11843	1.19900	0.08307	1.48137	2.21061	1.38400

Note: a) Industries 15 and 16 aggregated

b) Household final demand = national household final demand where possible

c) Employment multipliers for 1976/77 dollars

Table 6.5: Regional multipliers by industry

Industry	Multipliers											
	DIC	EC	DIIC	DIEC	T1OM	T1IM	T1EM	DIIIC	DIIEC	T2OM	T2IM	T2EM
1	0.09419	0.04200	0.12743	0.04709	1.10096	1.35288	1.12124	0.24550	0.04986	1.16899	2.60641	1.18713
2	0.26923	0.07547	0.30537	0.08133	1.11206	1.13423	1.07765	0.58831	0.08796	1.27509	2.18517	1.16551
3	0.26291	0.03571	0.35014	0.04841	1.29786	1.33179	1.35547	0.67457	0.05601	1.48479	2.56577	1.56836
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.15448	0.02020	0.18090	0.02455	1.09384	1.17100	1.21542	0.34852	0.02848	1.19042	2.25601	1.40987
6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
7	0.20153	0.02162	0.24134	0.02766	1.15238	1.19752	1.27961	0.46496	0.03290	1.28123	2.30710	1.52206
8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
9	0.16639	0.04457	0.27817	0.07175	1.60223	1.67175	1.60995	0.53591	0.07779	1.75075	3.22073	1.74549
10	0.18471	0.03793	0.24304	0.04792	1.25014	1.31577	1.26352	0.46823	0.05320	1.37990	2.53491	1.40267
11	0.28257	0.05331	0.33366	0.06113	1.15704	1.18077	1.14672	0.64281	0.06838	1.33517	2.27483	1.28262
12	0.24128	0.01398	0.29201	0.02262	1.17442	1.21026	1.61880	0.56258	0.02897	1.33033	2.33165	2.07250
13	0.31855	0.04129	0.38156	0.05040	1.20194	1.19780	1.22060	0.73510	0.05869	1.40565	2.30763	1.42124
14	0.33184	0.04438	0.37429	0.05062	1.13107	1.12792	1.14062	0.72109	0.05875	1.33090	1.17302	1.32375
15	0.00000	0.00000	0.04738	0.00868	1.17776	———	———	0.09128	0.00971	1.20306	———	———
16	0.54238	0.07890	0.59325	0.08682	1.15960	1.09397	1.10034	1.14312	0.09970	1.47638	2.10759	1.26363

Note: a) Household final demand = national household final demand x LQ_i

b) Employment multipliers for 1976/66 dollars

Table 6.6: Regional multipliers by industry

Industry	Multipliers											
	DIC	EC	DIIC	DIEC	T1OM	T1IM	T1EM	DIIIC	DIIEC	T2OM	T2IM	T2EM
1	0.09419	0.04200	0.16007	0.05915	1.38295	1.69940	1.40842	0.30335	0.06250	1.46468	3.22063	1.48823
2	0.26923	0.07547	0.30537	0.08133	1.11206	1.13423	1.07765	0.57873	0.08773	1.26798	2.14955	1.16238
3	0.26291	0.03571	0.35014	0.04841	1.29786	1.33179	1.35547	0.66358	0.05574	1.47663	2.52396	1.56076
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.15448	0.02020	0.18090	0.02455	1.09384	1.17101	1.21543	0.34284	0.02834	1.18620	2.21925	1.40293
6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
7	0.20153	0.02162	0.24134	0.02766	1.15239	1.19753	1.27963	0.45739	0.03271	1.27561	2.26951	1.51342
8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
9	0.16639	0.04457	0.27817	0.07175	1.60225	1.67177	1.60996	0.52718	0.07758	1.74428	3.16827	1.74066
10	0.18471	0.03793	0.24304	0.04792	1.25015	1.31578	1.26353	0.46060	0.05301	1.37424	2.49362	1.39771
11	0.28257	0.05331	0.33366	0.06113	1.15708	1.18080	1.14674	0.63235	0.06812	1.32744	2.23780	1.27779
12	0.24128	0.01398	0.29333	0.02283	1.18137	1.1573	1.63317	0.55591	0.02897	1.33114	2.30401	2.07264
13	0.31855	0.04129	0.38157	0.05041	1.20199	1.19783	1.22064	0.72314	0.05840	1.39681	2.27008	1.41412
14	0.33814	0.04438	0.37430	0.05063	1.13112	1.12795	1.14066	0.70936	0.05846	1.32223	2.13765	1.31724
15	0.00000	0.00000	0.47738	0.00868	1.17777	———	———	0.08980	0.00967	1.20196	———	———
16	0.54238	0.07890	0.59336	0.08682	1.15965	1.09398	1.10035	1.21451	0.09924	1.46260	2.07327	1.25782

Note: a) Household final demand = national household final demand where possible

b) Employment multipliers for 1976/77 dollars

Table 6.7: Regional multipliers by industry

The corresponding regional multipliers found in this study (employment, 1.25; and income, 1.17) are smaller. This is expected because of the non-existence of some industries in the local economy and the greater external leakages from smaller regions.

6.5 Visitor Expenditures

Section II of the questionnaire asked visitors to estimate their spending by category for locations within the Mackenzie Basin. It should be stressed that these estimates may differ from actual spending as often respondents still had to visit some of these locations. However, for major items such as accommodation, meals and petrol, a higher degree of certainty can be expected as these purchases are often planned in advance. Estimated accommodation and meal costs, obtained from tour brochures and accommodation guides, were added to out-of-pocket expenditures for pre-paid visitors. Mean expenditure by location and industry for main visitor types is reported in Table 6.8. Variance of individual expenditures is quite large within each group, limiting further breakdowns by visitor types. Figure 6.4 presents the 95% confidence estimates of mean adult per capita expenditure for major groups of visitors. From Figure 6.4 it is apparent that a much larger sample size would be necessary to adequately distinguish differences in spending by different visitor groups. However, it is possible to say that American visitors spend more than the average for all visitors while Taiwanese spend less. New Zealand visitors are about average in this respect.

6.6 Impacts of Different Visitor Types

Given the visitor expenditures of Table 6.8 and the multipliers of Table 6.7, it is possible to determine the effects that different visitor types have on the local economy. Groups have differing effects for two reasons:

- they spend different amounts of money; and
- they purchase different quantities of goods from each sector.

It cannot therefore be assumed that because Americans, on average, spend more money in the region than other visitors, they also provide

	OMARAMA	TEKAPO	TWIZEL	GLEN-TANNER	[1]MCNP	TOTAL	[2]INDUSTRY 11	[3]INDUSTRY 12	[4]INDUSTRY 13
All Visitors	2.93	9.87	1.07	1.92	42.18	58.09	10.43	36.19	11.56
<u>Visitors Arriving by</u>									
(1) Private Car	4.25	13.35	2.86	2.75	23.68	46.97	13.09	26.08	7.79
(2) Rental Car	4.48	6.27	1.24	3.18	53.43	68.99	16.18	33.97	19.05
(3) Tour Coach	1.90	13.81	0.05	1.17	36.02	52.95	4.86	42.61	5.48
(4) Air	0.40	0.00	0.00	0.00	69.11	69.51	9.08	39.14	21.41
<u>Country of Origin</u>									
Australia	3.92	10.51	0.60	2.36	40.24	57.84	10.20	35.65	12.23
Britain	1.66	13.00	0.87	1.16	27.90	44.59	8.57	27.21	8.80
West Germany	0.89	33.46	0.13	2.78	28.57	65.83	9.63	51.61	4.59
Japan	0.12	1.85	0.00	0.00	52.79	54.78	9.04	28.65	17.44
New Zealand	3.43	14.90	2.74	2.73	31.42	55.23	11.58	35.36	8.29
Switzerland	0.81	8.58	1.41	9.00	30.52	54.42	7.63	23.25	24.15
Taiwan	0.00	0.00	0.00	0.00	18.98	18.98	0.00	18.98	0.00
U.S.A.	2.13	4.78	0.46	1.64	74.20	83.26	13.50	49.82	19.86
Canada	4.96	6.00	0.68	2.13	46.90	60.68	9.65	41.69	9.34

[1]Mount Cook National Park

[2]Wholesale/Retail Industry

[3]Hotel and Accommodation Industry

[4]Service Industry

Table 6.8: Mean expenditures (1984$ per adult)

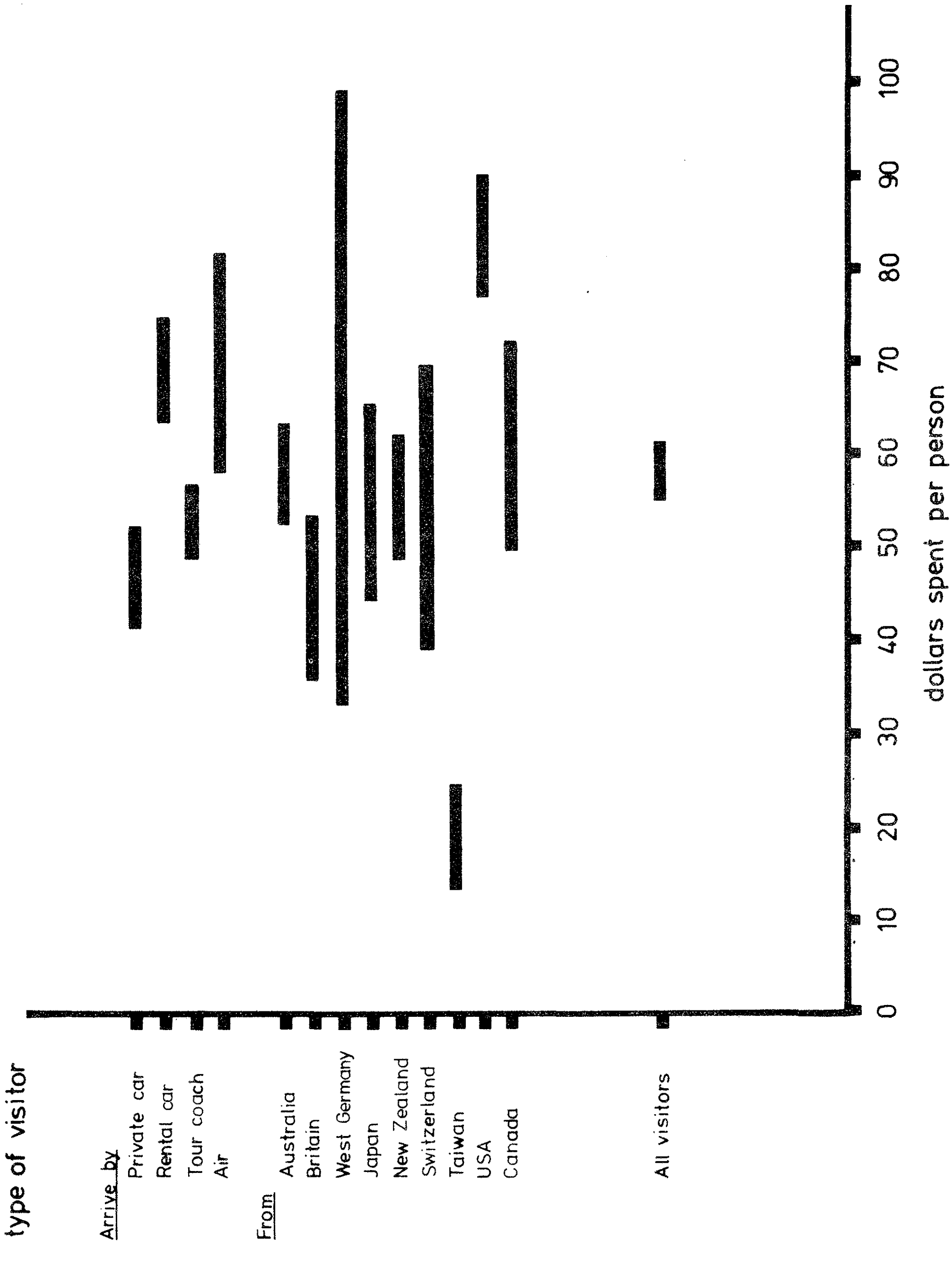


Figure 6.4: Ninety-five percent confidence intervals for adult per capita spending in Mackenzie Basin

the largest stimulus to regional incomes or employment. Table 6.9 summarises these effects for major visitor groups on an individual adult visitor basis, while Table 6.10 does the same on the basis of an average dollar spent by each visitor group. Expenditures were deflated back to December 1976 dollars to derive employment multipliers. The results summarised in Tables 6.9 and 6.10 should be viewed while bearing in mind the limitations imposed by their construction. First, it is expected that the multipliers produced by the GRIT method are biased upwards. Second, the mean per capita expenditures used in constructing these tables are only estimates and have large variances in most cases.

Inspection of Table 6.9 reveals that the average adult visitor, in spending $58 in the region, directly increases regional income by $18, and when indirect and induced effects are also considered local income increases by a total of about $40. When all multiplier effects are considered, one extra job is created within the region by every 869 adult visitors. Total increases in volume and number of jobs created in New Zealand would of course be greater than these figures indicate. It is apparent that American visitors have the largest income and job generating effects within the region. Table 6.10 reveals that this is because of their total spending rather than the distribution of that spending.

Our estimate of about $74,000 (1984) of direct tourist spending per regional job can be compared to Roberts' (1982) estimate of about $47,000 (1984) per job elsewhere in New Zealand for domestic tourists and about $45,000 (1984) for foreign tourists. The large leakages from the region explain the difference.

6.7 Effect of Expenditures on Park Management

The bulk of Park running costs spent within the region comprises wages and salaries, which for the 1984/85 year were $534,500 (D. Alexander, Dept Lands and Survey, *pers. comm.*). The average ordinary time yearly earning at May 1984 was nearly $15,000 (Dept of Labour, 1984). The average rate of tax on this income for the 1984/85 year

	INCOME (1984$/VISITOR)			OUTPUT (1984$/VISITOR)			VISITORS/JOB*		
	Direct	Direct + Indirect	Direct Indirect + Induced	Direct	Direct + Indirect	Direct Indirect + Induced	Direct	Direct + Indirect	Direct Indirect + Induced
All Visitors	17.94	20.96	39.71	58.18	69.23	78.93	1280	1023	869
<u>Arriving by</u>									
Private Car	14.22	16.64	31.54	46.96	54.99	63.49	1505	1220	1043
Rental Car	21.10	26.67	50.54	69.20	80.94	94.56	889	740	634
Tour Coach	14.63	17.37	32.92	52.95	62.32	71.19	1962	1447	1197
Air	23.62	27.21	51.58	69.63	81.57	95.47	929	763	651
<u>Origin</u>									
Australia	18.12	21.12	40.02	58.08	68.10	78.88	1257	1010	859
Britain	13.76	16.06	30.44	44.58	52.27	60.47	1649	1323	1124
West Germany	17.66	21.08	39.94	65.83	77.44	88.20	1581	1167	970
Japan	18.93	21.77	41.26	55.13	64.53	75.65	1119	929	795
New Zealand	16.30	19.16	30.30	55.23	64.79	74.57	1429	1129	957
Switzerland	20.86	23.70	44.91	55.03	64.30	76.40	957	816	704
Taiwan	4.58	5.57	10.55	18.98	22.42	25.27	9529	5830	4590
U.S.A.	26.61	30.90	58.57	83.18	97.51	113.29	846	684	583
Canada	17.85	20.99	39.78	60.68	71.25	81.97	1376	1073	904

***N.B.** This is the inverse of the employment multiplier, which is normally expressed as Jobs/Visitor

Table 6.9: Regional income, output and employment per adult visitor by visitor type

	INCOME ($/DOLLAR)			OUTPUT ($/DOLLAR)			1984 DOLLARS/JOB ($x10^3$)		
	Direct	Direct + Indirect	Direct Indirect + Induced	Direct	Direct + Indirect	Direct Indirect + Induced	Direct	Direct + Indirect	Direct Indirect + Induced
All Visitors	.309	.360	.683	1.000	1.173	1.357	74.2	60.1	50.5
<u>Arriving by</u>									
Private Car	.303	.354	.672	1.000	1.171	1.352	70.2	57.3	48.5
Rental Car	.334	.385	.730	1.000	1.170	1.366	61.6	51.5	44.2
Tour Coach	.276	.328	.622	1.000	1.177	1.344	105.3	76.5	63.4
Air	.339	.391	.741	1.000	1.172	1.371	64.6	52.5	45.2
<u>Origin</u>									
Australia	.312	.364	.689	1.000	1.173	1.358	72.2	58.8	49.5
Britain	.309	.360	.683	1.000	1.172	1.356	73.5	59.1	50.2
West Germany	.268	.320	.607	1.000	1.176	1.340	105.3	76.5	63.1
Japan	.343	.395	.748	1.000	1.171	1.372	61.6	51.5	43.4
New Zealand	.295	.347	.657	1.000	1.173	1.350	79.0	63.1	52.5
Switzerland	.379	.431	.816	1.000	1.168	1.388	52.5	45.2	38.9
Taiwan	.241	.293	.556	1.000	1.181	1.331	180.3	109.8	87.1
U.S.A.	.320	.372	.704	1.000	1.172	1.362	70.2	57.3	48.5
Canada	.294	.346	.656	1.000	1.174	1.351	84.1	64.6	54.8

***N.B.** This is the inverse of the employment multiplier

Table 6.10: Regional income, output and employment per dollar spent by visitor type

was 27.2% (Inland Revenue Dept., 1985). Assuming all Park staff were taxed at about the average rate, an estimate of take-home pay for local park staff would be $389,000.

If Park staff distribute their demands for goods as other consumers do, it is possible to calculate the income and employment effects of this injection to the local economy.

Regional income increases initially by the original $389,000, but about 32% of this is spent locally by the recipients. Multiplying the amount spent in each regional industry by that industry's multiplier, provides the total effect. Proceeding in this manner, a direct, indirect and induced income multiplier (DIIIC) for any increase in household income is 1.20. That is, for any dollar paid in wages to park staff, a further twenty cents is generated in regional household incomes. A similar exercise provides the direct, indirect and induced employment multiplier for the regional economy. Any 1984 dollar paid as wages by the Park board creates 0.693×10^{-5} jobs over and above those for which the wages are paid. Alternatively, one additional regional job is created by every $144,000 (net) paid by the Park in wages.

Park wages increase local household incomes (including Park staff) by about $467,000 and create 2.7 extra jobs outside the Park staff, as well as the Park jobs directly created.

7. Travel Cost Analysis

The travel cost analysis of visits to Mount Cook National Park can be conducted from two points of view depending upon the purpose of the valuation. If the Park is to be valued for all visitors, then everyone should be included in the travel cost model. However, if the value of the Park to New Zealanders alone is of concern, only New Zealanders should be considered. This chapter first applies the travel cost method to New Zealand visitors to Mount Cook National Park. The analysis is then extended to apply the method to visitors with international origins.

7.1 National Travel Costs Analysis

The use of an on-site survey and the low rate of annual visits by individuals precluded an individual travel cost model. To enable application of the aggregate, or zonal, model, New Zealand was divided into fourteen zones. These zones were based upon statistical and local body areas to simplify the collection of socio-economic data for base populations. The zones are shown in Figure 7.1

Once zones were identified it was possible to estimate the mean distance (weighted by population density) to the Park from each zone. The Mobil Road Map of New Zealand provided estimates of mean travel time for those travelling by car. To simplify analysis it is assumed that all New Zealanders travel to the Park by car. This is true for 77% of New Zealanders, with nearly all the rest travelling by tour coach.

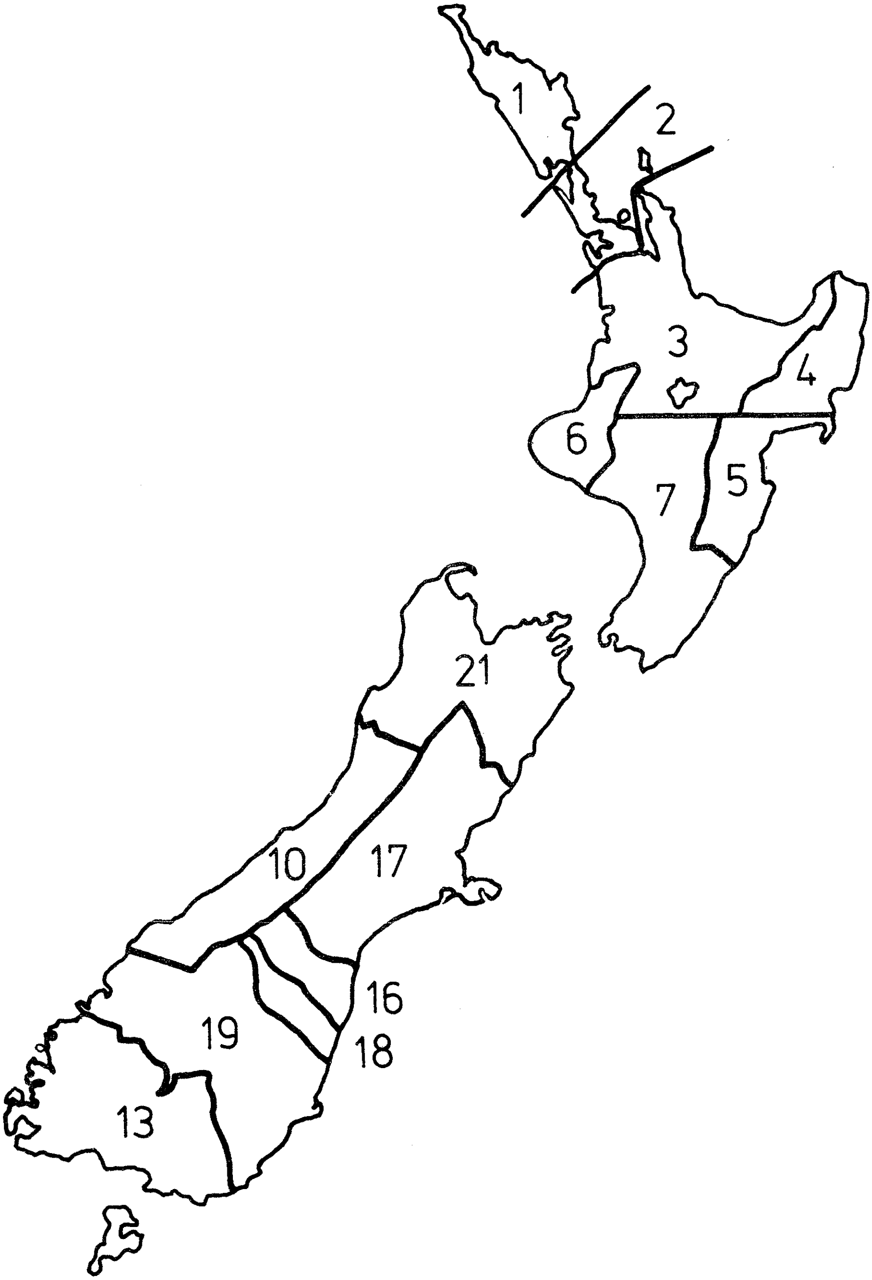


Figure 7.1: New Zealand travel cost zones

Actual per capita return travel costs were calculated for each zone as follows:

$$TC_i = \frac{(D_i \times A + B)}{N_i} + C + T_i \times V$$

where

D_i = mean return distance (km) to the Park from zone i;

A = variable cost of running a mid-sized car ($0.23/km; Ministry of Transport, 1984);

B = cost of return crossing on Cook Strait ferry for a mid-sized car ($143.00). B = 0 if zone is in the South Island;

C = return adult fare on Cook Strait ferry ($33.40). Zero if South Island zone;

N_i = mean number of adults per car from zone i;

T_i = return travel time from zone i; and

V = value of travel time.

No data were collected to allow for the differences in substitute sites available to visitors.

Following Cox (1983) travel time (V) has been valued at 25% of the average adult gross wage, which at August 1984 was $7.80 per hours (Department of Labour). Because we had no way of valuing time on-site this was set at zero. This does not bias results if visitors from all zones spend the same amount of time on-site.

Most visitors are on multi-destination trips so, to allow an application of Haspel and Johnson's (1982) technique, a new travel costs variable was defined. This was found by dividing per capita travel cost, as previously defined, by the mean number of major destinations (including the Park) on the trip for each zone.

For example:

$$HJ_i = TC_i/STOPS_i$$

where

$STOPS_i$ = mean number of major destinations for visitors from zone i

Other variables which might helo to explain multi-destination trips include:

TNITES = the percentage of total trip nights spent at Mount Cook National Park; and

DNITES = the percentage of nights at major destinations spent at Mount Cook National Park.

The major destinations referred to in defining these variables are those listed in response to question 13 in part I of the questionnaire.

Variables reflecting the socio-economic characteristics of the base population of each zone are (based on 1981 census data):

AGE = % of population over 60 years of age;

RACE = % of population of European decent;

INCOME = % of adult population earning more than $18,000 per annum;

ED = % of adults without tertiary education;

CAR = % of households owning at least one car; and

HOME = % of households owing their own home (with or without a mortgage).

Further variables are:

LENGTH = mean length of trip (days); and

NITES = mean number of nights at Mount Cook National Park.

These variables were used to construct models for predicting zonal visitation rates. The normal travel cost variable (TC) and the travel cost variable adjusted for number of destinations (HJ) were employed in separate models. Neither was significantly different to the other in predicting zonal visitation rates (visits per capital, V). A summary of the best regression is presented in Table 7.1.

Model	Dependent variable	Independent variable(s)	Mean squared error*	Adjusted R^2
Independent travel cost variable = TC				
1	V	TC	2.37	.48
2	V	ℓn(TC)	1.39	.69
3	V	(1/TC)	0.67	.85
4	ℓn(V)	TC	0.46	.66
5	ℓn(V)	ℓn(TC)	0.30	.78
6	ℓn(V)	ℓn(TC),ℓn(ED)	0.19	.86
Independent travel cost variable = HJ				
7	V	HJ	2.72	.42
8	V	ℓn(HJ)	2.13	.55
9	V	1/HJ	1.70	.64
10	ℓn(V)	HJ	0.44	.67
11	ℓn(V)	ℓn(HJ)	0.36	.73
12	ℓn(V)	HJ,NITES	0.34	.74

*For transformed dependent variables to allow comparison (Rao and Miller, 1971)

Table 7.1: Summary of visitation rate models

The only non travel-cost type variables to be significant were those representing education [ℓn(ED)] and number of nights spent at the Park (NITES), the latter only at the 10% level. This is to be expected in highly aggregated models where travel cost is a major determinant of visits.

The adjusted R^2 statistic may only be used for comparison of models with the same independent variable. to overcome this problem, Rao and Miller's (1971) procedure of adjusting the dependent variable to allow comparison of residual sums of squares was followed. Mean square errors found using this procedure are reported in Table 7.1 and provide a basis for evaluating the precision of the models in estimating zonal visitation rates. On these grounds, models 1, 2, 7, 8 and 9 are ruled out of further analysis. The remaining models show little difference in predictive ability and are retained to allow a check on consistency between functional forms. These models are presented in Table 7.2.

	Model						
	3	4	5	6	10	11	12
Dependent variable	V	ℓn(V)	ℓn(V)	ℓn(V)	ℓn(V)	ℓn(V)	ℓn(V)
Constant	$-.6555\times 1^{-4}$	-7.30535	-2.58920	12.60892	-7.13486	-3.30156	-7.61332
	(-1.151)	$(-22.065)^c$	$(-2.851)^a$	$(2.370)^a$	$(-20.512)^c$	$(-3.529)^b$	$(-19.640)^c$
TC		-0.00554					
		$(-5.112)^c$					
ℓn(TC)			-1.17093	-0.96530			
			$(-6.840)^c$	$(-6.324)^c$			
(1/TC)	0.04808						
	$(8.763)^c$						
HJ					-0.2167		-0.02363
					$(-5.020)^c$		$(-6.006)^c$
ℓn(HJ)						-1.33186	
						$(-5.775)^c$	
ℓn(ED)					-4.04079		
					$(-2.883)^a$		
NITES							1.06981
							(2.024)
MSE*	0.67	0.46	0.30	0.19	0.44	0.36	0.34
F	76.784^c	26.137^c	46.780^c	41.800^c	25.202^c	33.351^c	18.198^c
R^2	0.86	0.69	0.80	0.88	0.70	0.75	0.78

[a]Significant at 0.05 level

[b]Significant at 0.01 level

[c]Significant at 0.001 level

*Mean squared error with transformed dependent variable (Rao and Miller, 1971)

Table 7.2: Best visitation rate models (t-scores in parentheses)

Bowes and Loomis (1980) suggest the possibility of heteroscedasticity in travel cost models with unequal zonal populations. All models presented in Table 7.2 were tested for this possibility using the Goldfeld-Quandt test. All proved to be homoscedastic. Table 7.3 presents predicted numbers of visits from each zone using each of the models presented in Table 7.2. All models under-estimate total visits, but generally distribute visits in the correct proportions between zones. The largest discrepancies occurred in zones two and nineteen (Auckland and South Otago), where the actual number of visits greatly exceeded predicted visits in all models.

Zone	Actual visits	Visits predicted by model							
		3	4	5	6	10	11	12	
1	5	7	10	8	7	1	4	0	Northland
2	131	33	45	48	79	46	50	89	Auckland
3	30	22	30	30	35	58	46	49	S.A./B.O.P.
4	3	1	1	2	1	2	2	2	East Coast
5	4	5	7	8	6	7	8	3	Hawkes Bay
6	9	6	9	7	5	7	7	7	Taranaki
7	84	50	68	52	114	111	81	120	Wellington
10	2	5	6	4	3	3	2	5	Westland
13	21	39	39	32	23	45	43	39	Southland
16	72	69	32	61	55	33	54	35	S.Canty
17	150	219	164	183	189	182	225	171	N.Canty
18	14	15	10	13	14	8	8	11	N.Otago
19	153	95	72	79	91	64	59	64	S.Otago
21	25	25	30	1	27	44	40	30	Nelson/Marl.
Total	703	591	523	548	649	611	629	-	
Total*	698	-	-	-	-	-	-	625	

*Model 12 had one zone less than other models

Table 7.3: Visits at zero entry fee by zone for travel cost models

Incrementing the appropriate travel cost variable in each model allows prediction of total number of visits at any cost, and hence the plotting of aggregate demand curves for visits to the Park. These are presented in Table 7.4 and Figures 7.2 and 7.3.

	Preliminary demand curve model						
Entry fee	3	4	5	6	10	11	12
(1984$)	(Unadjusted models)				(Multi-destination models)		
0	591	523	548	649	611	629	625
25	439	455	419	529	355	304	341
50	346	396	342	458	202	201	188
75	281	344	294	406	114	149	101
100	233	297	257	368	64	116	54
150	164	223	209	311	19	78	13
200	116	169	176	272	3	57	2
300	52	92	133	218	0	37	0
400	25	51	110	186		25	
500	10	26	91	160		17	
600	2	14	75	141		13	
700	0	5	67	127		11	
800		1	57	114		8	
900		1	52	105		6	
1,000		0	47	95		6	
1,200			38	81		5	
1,500			30	68		2	
2,000			22	53		1	

Table 7.4: Predicted numbers of visits with varying entry fees

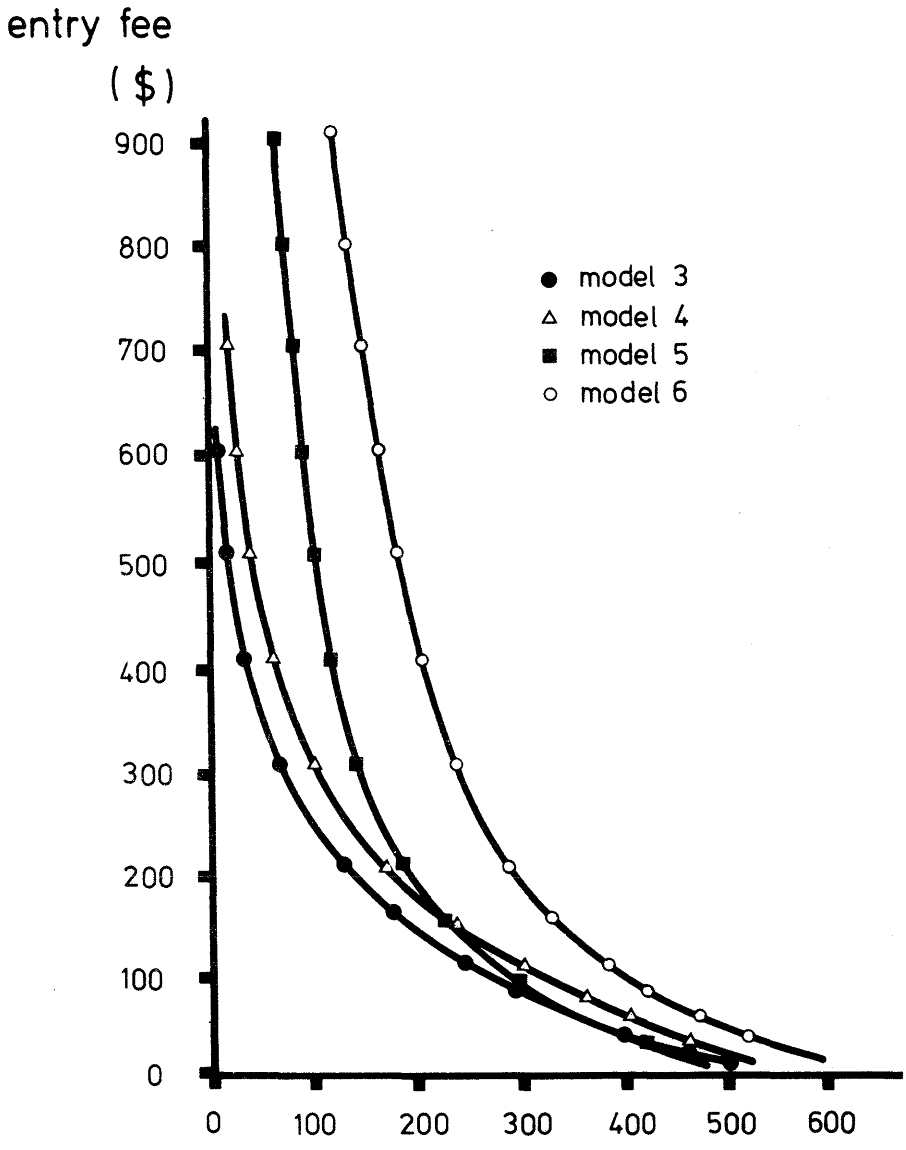


Figure 7.2: Demand for visits by New Zealanders (Single destination trips)

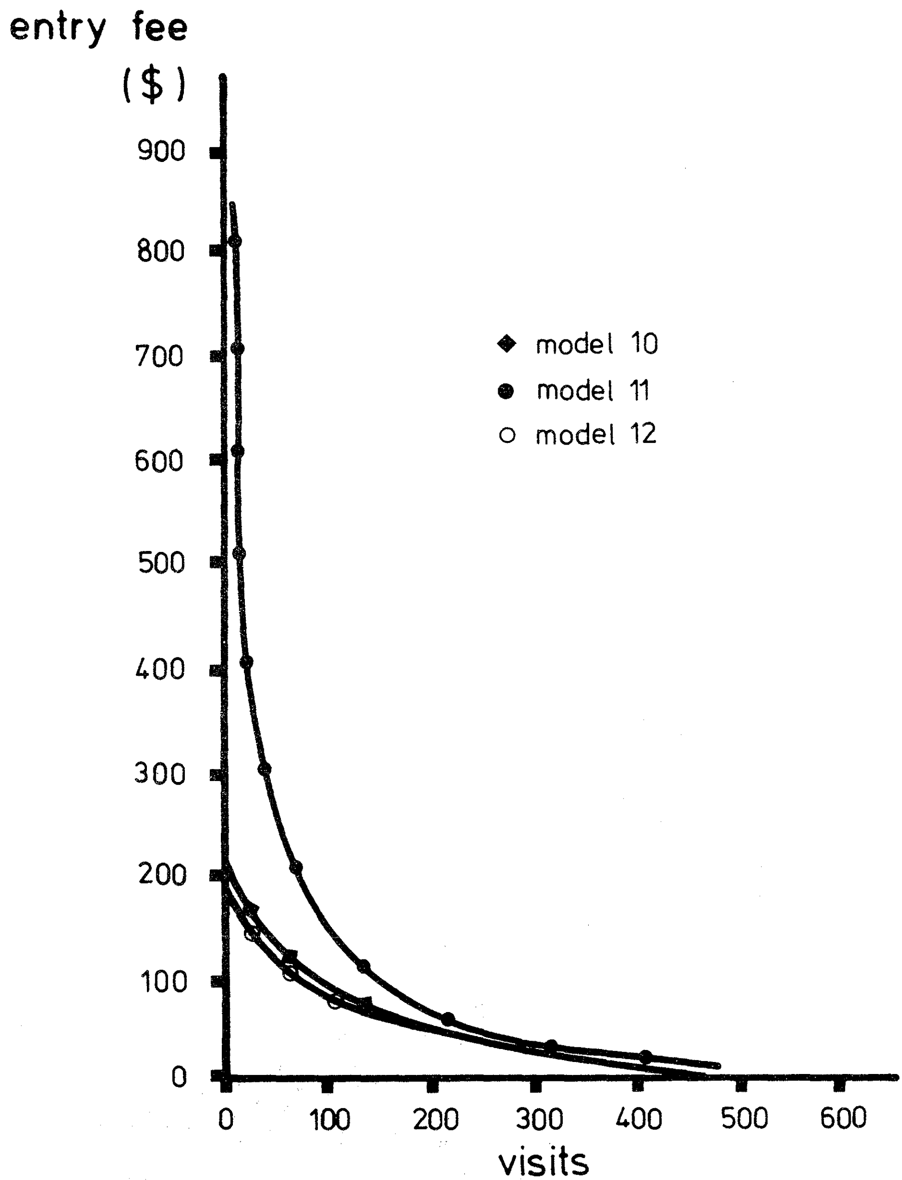


Figure 7.3: Demand for visits by New Zealanders (Multi-destination trips)

It is notable that the multi-destination adjusted demand curves are more elastic than demand curves based upon the unadjusted travel cost variable - providing lower estimates of consumers' surplus. Of further note is the asymptotic nature of demand curves 5, 6 and 11 - the log-linear specifications of the preliminary demand functions, this implies infinite consumers' surplus. For the non-asymptotic models visits fall to zero at the following entry fees.

Normal travel cost variable	Model 3	- \$630
	Model 4	- \$920
Multi-destination travel cost variable	Model 10	- \$250
	Model 12	- \$220

These values provide guidelines for choosing P_{max}, the entry fee at which visits are assumed to fall to zero for the asymptotic models. Geometrically estimated mean consumers' surplus values for each model are presented in Table 7.5.

Unadjusted models:					
P_{max}	\$600	\$700	\$800	\$900	\$1,000
Model 3	116				
Model 4				173	
Model 5	107	117	130	138	147
Model 6	112	126	141	153	167
Mean C.S.	12	133	140	145	151
Multi-destination models:					
P_{max}	\$200	\$250	\$300	\$350	\$400
Model 10	46				
Model 11	36	40	44	47	50
Model 12	42				
Mean C.S.	41	43	44	45	46

Table 7.5: Mean consumers' surplus for New Zealand visitors (1984\$)

We consider that the Haspel and Johnson method deals most adequately with multiple destination trips and therefore suggest that $44 is the most likely estimate of mean consumers' surplus. We have no means of validating this assertion. The assumptions and limitations of this type of model should be reiterated. There is no theoretically justified means of allocating joint costs so ad hoc techniques must be employed. In this case travel costs are divided equally between all major destinations - implying that the value of Mount Cook National Park is identical to the mean value of all other major destinations. If the Park is more important than other destinations its value will be underestimated by this technique and vice versa. Travel cost is estimated as the cost of a return trip to the Park from the visitor's home, without accounting for extra mileage involved in visiting other sites, which we know happens. For example, visitors from Auckland often visit the Park, Queenstown, Milford Sound and the West Coast glaciers on a trip around the South Island. Counting only return mileage to the Park will underestimate total travel costs. If extra mileage associated with other destinations is positively related to travel costs, the estimates of consumers' surplus found here will be too low. The Spearman rank correlation coefficient between travel cost and number of destinations is 0.47, indicating a significant (α=0.05) positive relationship and suggesting that it is possible that we have under-valued Mount Cook National Park.

Two recent travel costs studies of New Zealand recreational resources, both for largely single objective trips, provide comparative values. Harris (1981) estimated a mean consumers' surplus of $12.50 (1984$) per visitor-day at Lake Tutira - a small lake used mainly for picnicking and sailing. Lake Tutira is not as nationally significant as Mount Cook National Park, with over 60% of visits originating within a 100 km radius of the lake (Harris, 1981).

Sandrey and Simmons (1984) estimate mean consumers' surplus of $30.81 (1984$) per visit to the Kaimanawa and Kaweka Forest Parks. Situated in the central North Island these Parks are visited by some 20 000 people each year from all over the North Island.

In view of these findings mean consumers' surplus of $44 per visit to Mount Cook National Park, which is of national and international significance, is unlikely to be an over-estimate.

7.2 World Travel Cost Analysis

We have estimated the primary benefits of visits to Mount Cook National Park by New Zealanders. Overseas visitors also derive consumers' surplus from their visits. Before attempting to quantify these benefits we discuss the major difficulties in applying the travel cost method to an international sample.

7.2.1 Response Rates

Estimates of visits from each zone are based upon numbers reported in returned questionnaires. Since there is no independent record of the number of people from each zone sampled, estimates are dependent upon the survey response rate. If visitors from different zones respond at different rates, relative numbers of visits per zone will be distorted. There is evidence to suggest that response rates are non-homogeneous. Questionnaires were distributed in two languages - English and Japanese. Response rates were 47.3% and 23.2% respectively (on questionnaires, not people).

It can also be surmised that language difficulties would present more of a barrier to some nationalities (eg. Chinese) than to others (eg. English). Since this survey had no means of testing for response rates by nationality, application of the travel cost method requires an assumption of constant response rates.

7.2.2 Tastes and Socio-economic Factors

The travel cost method is reliant upon the assumption that the populations of all zones have equal abilities and desires to visit the site in question. This assumption is usually untenable and socio-economic variables are often included amongst the regressors to account for such differences. These variables may help to eliminate the effect of varying abilities to visit a site. It is difficult to imagine a set of variables that would adequately account for differences in tastes. It is therefore necessary to assume homogeneous tastes. This may not be too restrictive within one country, or even one culture, but could have serious effects worldwide.

The inclusion of socio-economic variables is a difficult task in international models. Things likely to be important are education levels, income, income distribution, availability of transport, health, etc. For many less developed countries this information is simply not available, and where it is available it is often not comparable. The only data available within the scope of this study to incorporate some of these effects is per capita gross national product expressed in United States dollars for 1980.

7.2.3 Transport Factors

The combination of multi-country trips and a vast array of international air fares poses a further problem. Multi-country trips could be treated in the same manner as multi-destination trips within the same country, except that air fares vary, largely depending upon the number of stops made. Economy fares allow unlimited stopovers, while epic or excursion fares allow only limited or no stopovers. Fares also vary by time of year, according to peak-load pricing strategies of airlines.

It was not possible to identify the type of fare paid by individual visitors to the Park, necessitating the employment of some kind of average. Economy and epic fares, denominated in New Zealand dollars as at June 7 1984, were used to define two variables to allocate the cost of international air travel to New Zealand (Haspel and Johnson, 1982). These are:

$$\text{ECON} = \frac{\text{Return economy air fare}}{\text{Number of countries visited, excluding 1 night stopovers}}$$

and

$$\text{EPIC} = \text{Return epic air fare.}$$

There is also a problem in estimating the value of travel time. Hourly wage data are not available for many countries and are not strictly comparable in those cases where they are available. Consequently, it is not possible to estimate the value of travel time as a constant fraction of the wage rate. One is forced to use a value of zero on travel time. Varying modes of transport and composition of trips, both within the visitor's home country and in New Zealand, cannot be adequately described by the information collected in the survey, requiring a further simplifying assumption that the cost of all trips within New Zealand plus the cost of reaching the international departure point in the home country are identical for all visitors. The assumption seems quite appropriate for the New Zealand leg of the trip when various "typical" holidays are priced, and it is considered that no nationalities are restricted in choice of their mode of travel within New Zealand. No attempt has been made to justify the home country travel part of the assumption. Using this assumption, there is no need to place a value on these two components of the trip costs, and the relevant travel cost variable is the price of international travel only, **as long as** the functional form of the visitation rate function is constrained. Any transformation of the travel cost variable plus a constant ($TC + \phi$) must be able to be expressed in the same form as a transformation of the original travel cost variable (TC). For example,

$$\begin{aligned} Y &= a + b(TC + \phi) \\ &= a + bTC + b\phi \\ &= a + b\phi + bTC \\ &= a^1 + bTC \end{aligned}$$

is an appropriate form for the independent variable while

$$Y = a + \frac{b}{TC}$$

and, $T = a + b\,\ell n(TC)$

are not. The form of the dependent variable is unconstrained.

7.2.4 Other Factors

Other factors may also have an influence on potential visitors to the Park. These may include political, language and cultural barriers.

Also of importance will be the extent to which New Zealand, and Mount Cook in particular, are marketed in various countries. These effects have not been accounted for in this study.

7.3 Application of the Travel Cost Method to the World Sample

All visitors to Mount Cook National Park were allocated to one of 28 different zones. Most zones are based on individual countries, but Canada and the United States are split into three and five zones respectively. To estimate the preliminary demand curve the following set of regressions was run:

(a) $V = \alpha_0 + \beta_0(TC) + \phi$

(b) $V = \alpha_1 + \beta_1(TC) + \gamma_1(TC)^2 + \phi$

(c) $\ell n(V) = \alpha_2 + \beta_2(TC) + \phi$

(d) $\ell n(V) = \alpha_3 + \beta_3(TC) + \gamma_3(TC)^2 + \phi$

(e) $1/V = \alpha_4 + \beta_4(TC) + \phi$

where

V = Visits per capita x 10^3;

TC = either - ECON/Number of major New Zealand destinations
or - EPIC/Number of major New Zealand destinations; and

ϕ = a vector of other explantory variables, including:

- ▲ Gross national product per capita (GNP),
- ▲ length of stay in New Zealand (TIME),
- ▲ number of nights spent at Mount Cook National Park (NITES)

New Zealand has great influence in determining the form of the preliminary demand curve. To test the significance of this effect two parallel analyses were conducted, including and excluding New Zealand respectively. The rationale for this procedure is that New Zealanders may have different tastes than others for visits to Mount Cook National Park. These may occur for cultural, historic, or other reasons.

In no case was a model of type (a) or type (e) statistically significant, and in all cases models of type (d) were far superior to those of type (c). Further analysis was limited to models of types (b) and (d).

7.3.1 World Travel Cost Models Excluding New Zealand

For the cases exclusive of New Zealand, the Rao and Miller test of functional forms proved non-logged visitation rate variable models to be superior to their logged counterparts. No statistically significant model could be found using economy air fares. Using epic air fares the best model found was (t-values in parentheses):

(A)

$$V = \underset{(1.975)}{0.0138} - \underset{(-2.297)}{0.325\times10^{-5}}(TC) + \underset{(2.164)}{0.1114\times10^{-7}}(TC)^2 + \underset{(2.043)}{0.115\times10^{-5}}(GNP)$$

$n = 25$

$R^2 = 0.27$

$F = 2.53$

The t-values on TC and TC^2 are both significant at the 5% level, while those on GNP and the constant are significant at the 10% level. The whole equation is significant at the 10% level. However, when the predictive power of this model is tested on a country by country basis it appears deficient, as indicated by Table 7.6. Total predicted visits are more than twice the actual number of visits, and there are errors of several hundred percent in many of the zones. Applying the Goldfeld-Quandt test proves this model to be heteroscedastic, so it has been re-estimated after weighting by the square root of zonal population to give:

(B)

$$V = \underset{(2.731)}{0.01761} - \underset{(-2.714)}{0.358\times10^{4}}(TC) + \underset{(2.223)}{0.1283\times10^{-7}}(TC)^2 + \underset{(1.757)}{0.3950\times10^{-6}}(GNP)$$

All t-values are significant at the 5% level, except for GNP which is significant at the 10% level.

Visits predicted for each zone using this model are reported in Table 7.6. While the overall number of visits is better than with (A), estimated visits from individual zones show very little correspondence with actual visits and no confidence could be placed in a demand curve derived using this model.

Zone	Actual visits	Predicted using (A)	Predicted using (B)
2	639	236	202
3	32	12	8
4	5	1	0
5	212	314	137
6	92	476	166
7	118	433	0
8	168	731	437
9	134	71	4
11	20	19	8
12	25	9	0
13	44	67	0
14	54	676	436
15	27	84	46
16	20	0	15
17	18	24	38
18	18	123	76
19	12	0	0
20	11	0	14
21	10	24	33
23	6	118	25
24	4	39	44
25	4	24	0
26	2	99	85
27	2	0	82
28	2	0	0
Total	1 679	3 579	1 855

Table 7.6: Actual and predicted visits for travel cost models excluding NZ

We now turn to models including New Zealand to determine whether they improve predictive power.

7.3.2 World Travel Cost Models Including New Zealand

Recall that it was found earlier that the two models

(b) $V = \alpha_1 + \beta_1(TC) + \gamma_1(TC)^2 + \phi$

(d) $\ell n(V) = \alpha_3 + \beta_3(TC) + \gamma_3(TC)^2 + \phi$

were the best of our original set. Type (b) models all proved to be heteroscedastic while type (d) were not, as predicted by Strong (1983). Hence, all type (b) models are estimated after weighting by the square root of population. Regression results for models including New Zealand are summarised in Tables 7.7. and 7.8, for economy and epic fares respectively.

Model name	Economy 1	Economy 2	Economy 3	Economy 4	Economy 5
Dependent variable	ℓn (V)	ℓn (V)	ℓn (V)	ℓn (V)	V
Constant	-3.49670	-4.7113	-4.62484	-5.6133	0.02880
	(-2.806)	(-4.280)	(-3.777)	(-5.367)	(1.986)
TC	-0.01001	-0.01178	-0.01139	-0.01286	-.8868x10
	(-2.650)	(-3.680)	(-3.264)	(-4.434)	(-1.844)
TC^2	0.6135x10	0.70669x10	0.72436x10	0.79723x10	0.6322x10
	(2.708)	(3.692)	(3.428)	(4.553)	(1.640)
GNP		0.31435x10		0.29181x10	
		(3.427)		(3.528)	
NITES			2.07164	1.81631	
			(2.468)	(2.615)	
R^2	0.23	0.48	0.38	0.60	0.14
F	3.69	7.43	4.99	8.64	1.39
Significance	0.04	0.001	0.01	0.0002	0.27

Table 7.7: Regression results for visitation rate models using Economy air fares (inclusive of New Zealand - t-score in parentheses)

Model name	Epic 1	Epic 2	Epic 3	Epic 4	Epic 5
Dependent variable	ℓn (V)	ℓn (V)	ℓn (V)	ℓn (V)	V
Constant	-4.25123	-5.54451	-5.56022	-6.74336	0.09251
	(-3.416)	(-4.982)	(-4.368)	(-6.288)	(4.062)
TC	-0.00482	-0.00678	-0.00549	-0.00736	-.16847x10
	(-1.864)	(-3.023)	(-2.298)	(-3.707)	(-3.561)
TC^2	0.18503x10	0.26109x10	0.23014x10	0.30143x10	0.552x10
	(1.893)	(3.072)	(2.510)	(3.957)	(3.086)
GNP		0.34949x10		0.33864x10	
		(3.294)		(3.627)	
NITES			2.09483	1.9828	
			(2.318)	(2.731)	
R^2	0.14	0.42	0.31	0.57	0.36
F	1.83	5.36	3.24	7.06	6.59
Significance	0.18	0.01	0.04	0.001	0.01

Table 7.8: Regression results for visitation rate models using Epic air fares (inclusive of New Zealand - t-scores in parentheses)

Using both forms of the travel cost variable (Epic and Economy) the Rao and Miller test shows that logged forms of the dependent variable are superior at the 0.1% level. However, the best models with untransformed dependent variables will be retained for comparison. The number of visits to Mount Cook National Park predicted for each zone at zero entry fee by the models of Tables 7.7 and 7.8 are presented in Table 7.9. Those models estimated using weighted least squares (Economy 5 and Epic 5) predict the total number of visits exactly when negative numbers of visits are allowed. Setting visits to zero for zones where the predicted number of visits is negative causes overestimation of total visits. The closest any model comes to predicting total visits correctly is 85%. The situation for individual zones is worse, commonly being in error by an order of magnitude, often by two or three orders of magnitude.

Zone	Actual visits	PREDICTED VISITS Economy 1	Economy 2	Economy 3	Economy 4	Economy 5
1	749	93	113	107	126	89
2	639	44	85	64	113	132
3	32	1	4	4	10	2
4	5	1	8	2	13	10
5	212	51	173	83	243	113
6	92	95	246	144	331	191
7	118	68	135	93	169	0
8	168	62	64	36	39	0
9	134	38	23	471	215	0
10	103	68	20	33	11	196
11	20	4	12	5	13	12
12	25	3	6	5	9	0
13	44	29	70	41	89	80
14	54	37	77	19	41	0
15	27	17	107	10	59	52
16	20	21	5	9	2	56
17	18	90	45	57	32	173
18	18	7	10	10	13	0
19	12	2	0	1	0	19
20	11	27	6	38	9	5
21	10	25	7	55	15	54
22	7	81	12	75	13	0
23	6	44	115	14	40	128
24	4	29	14	60	29	73
25	4	8	12	1	3	0
26	2	7	9	1	2	8
27	2	983	175	219	53	2313
28	2	35	6	60	10	0
Total	2538	1970	1559	1717	1702	3706

Table 7.9: Predictive ability of selected travel cost models (all models inclusive of New Zealand)

		PREDICTED VISITS				
Zone	Actual visits	Epic 1	Epic 2	Epic 3	Epic 4	Epic 5
1	749	44	57	42	55	138
2	639	85	210	128	298	416
3	32	2	9	8	28	13
4	5	0	1	0	1	0
5	212	51	152	80	228	68
6	92	87	186	129	263	0
7	118	101	173	141	234	0
8	168	190	209	110	125	552
9	134	63	30	809	346	0
10	-	-	-	-	-	-
11	20	3	8	3	8	4
12	25	3	4	5	7	0
13	44	15	25	20	33	0
14	54	138	363	74	195	660
15	27	13	78	7	41	57
16	20	20	3	8	1	49
17	18	39	30	36	28	102
18	18	26	47	37	63	106
19	12	2	0	1	0	0
20	11	40	7	58	10	52
21	10	17	3	33	7	85
22	-	-	-	-	-	-
23	6	23	43	7	13	0
24	4	19	7	35	14	103
25	4	8	9	1	2	0
26	2	33	53	7	13	174
27	2	936	106	198	26	1359
28	2	51	5	88	10	0
Total	2428	2009	1818	2065	2049	3938

Table 7.9: contd

The poor predictive performance of these models indicates there is no point in proceeding with the next stage of analysis - varying travel costs to derive a demand curve for visits to the Park. Whether this step would have been possible is open to doubt for another reason. The only statistically significant models contained the square of the travel-cost variable with a positive coefficient. This indicates that if travel costs are increased sufficiently, visits will actually increase. If this occurs when travel costs are close to those existing before an entry fee is added, the travel cost method would only be able to predict a small section of the demand curve. Model Economy 5 suggests that visits will increase with an increase in travel cost after travel cost reaches $706 and Model Epic 5 suggests a figure of $1,526 for its travel cost variable. These figures are already surpassed by twelve zones and one zone respectively.

7.4 Summary

The travel cost method of estimating aggregate demand for visits to Mount Cook National Park has been applied to two samples of visitors - New Zealanders only and visitors from all over the world. The method appears to be successful in the first case. The travel cost method was unsuccessful with the world-wide sample of visitors. It is likely that several factors contributed. Determination of total trip costs was not possible, requiring the assumption of homogeneity of trips at both ends of the international section of the trip, and also restrictions on functional form. Differences in abilities to visit the Park were summarised in only one variable, gross national product per capita, which was probably inadequate for the task. It was not possible to describe factors affecting desire to visit, which are likely to differ across zones for cultural, historical and other reasons. Response rates may also have varied significantly between countries. It is possible the Haspel and Johnson procedure for allocation of joint costs may not be appropriate for international travel, although this is unlikely considering the Epic fare models also failed. It is possible, although the effort required may be very large, to document individual trips more fully to better describe the non-international sections of trips. A larger sample size would allow more zones and the inclusion of more variables to better describe tastes and abilities to visit the Park. The introduction of more zones increases the difficulty of obtaining comparable data.

Conclusions

In this report we have provided a review of the economic theory that underpins empirical models for estimating the economic benefits of Mount Cook National Park. Estimates of use-value were obtained using the travel cost method. Regional economic multipliers associated with visitor expenditures were estimated using the GRIT method. In this final chapter we present the conclusions to our study, along with a discussion on how the results should be interpreted, and suggestions for future research.

8.1 Summary of Results

Table 8.1 shows the number of visitors, and the approximate annual number of visitors expected, from each country in our sample. The average expenditure within the study region for all adult Park visitors was $58, for New Zealanders it was $55, this difference is not statistically significant. This implies that, on average, individual domestic and foreign tourists have very similar effects on regional development. There appears to be no regional advantage in promoting one group over another. The estimated effects of an individual visit to the Park, and the total effect of all visits for the year 1984 are shown in Table 8.2. It should be recalled that because of the inherent bias of the GRIT method the number of jobs and monetary impacts described here are exaggerated.

Country	Number in Sample	Approximate Expected Annual Number
Australia	639	42 500
Austria	2	130
Bahrain	2	130
Bermuda	1	65
Britain	134	8 900
Canada	89	5 900
France	1	65
Germany	54	3 600
Hong Kong	4	270
India	2	130
Indonesia	7	470
Ireland	18	1 200
Japan	168	11 200
Malaysia	20	1 300
Netherlands	18	1 200
New Caledonia	10	670
New Zealand	749	49 800
Papua New Guinea	10	670
Philippines	2	130
Saudi Arabia	4	65
Scandinavia	6	400
Singapore	12	800
South Africa	11	700
Switzerland	27	1 800
Taiwan	103	6 900
Thailand	1	65
United States	450	29 900
Vanuatu	2	130
Unknown	99	-
Total	2 655	170 000

Table 8.1: Adult visitor origins

Regional Change In	Effect of One Visitor (1984$)	Effect of All Visitors (1984$)
Direct output	$58.18	$ 9.9 million
Direct+indirect output	$68.23	$11.6 million
Direct+indirect+induced output	$78.93	$13.4 million
Direct income	$17.95	$ 3.1 million
Direct+indirect income	$20.96	$ 3.6 million
Direct+indirect+induced income	$39.71	$ 6.8 million
Direct employment	0.781×10^{-3} jobs	133 jobs
Direct+indirect employment	0.978×10^{-3} jobs	166 jobs
Direct+indirect+induced employment	1.045×10^{-3} jobs	196 jobs

Table 8.2: Secondary effects of Park visitors

It was not possible to estimate aggregate consumers' surplus for all visitors to the Park. However, we are able to estimate a mean consumers' surplus value of about $44 per visit for adult New Zealanders of about $2.2 million. Since the mean consumers' surplus and total number of visits by New Zealand adults are only estimates we show the sensitivity of total consumers' surplus to changes in these two estimates in Table 8.3. It appears most likely that annual use value of Mount Cook National Park to adult New Zealanders is about $2 million.

Because travel costs are generally higher for foreign visitors it is expected that their mean consumers' surplus will be less than the mean for New Zealanders. An upper bound on total use-value can therefore be provided by assuming that every visitor derives $44 consumer surplus. This implies an upper limit on use-value, to all visitors of:

$44 per visit x 170 000 adult visitors/year ≈ $7.5 million/year

Number of Annual Visists by Adult New Zealanders	Mean Consumers' Surplus (1984$)	Total Consumers' Surplus (1984x10^6$)
40 000	35	1.40
	44	1.76
	55	2.20
50 000	35	1.75
	44	2.20
	55	2.75
60 000	35	2.10
	44	2.65
	55	3.30

Table 8.3: Total consumers' surplus for adult New Zealanders

8.2 Interpretation of Results

In Chapter 2 of this report we developed a model that can be used to describe the optimal number of visits to a national park. The total cost of providing the services that facilitate visitation include the opportunity cost of the land resource and the cost of maintaining and operating the park. In this study total benefits are given by what visitors are willing to pay for a visit. We have noted that use-related benefits are an underestimate of total value, which includes other benefits such as: existence, bequest, and option values.

The national net (use) benefits associated with Mount Cook National Park in any particular year are given by:

$$NB = CS_{NZ} + NB_F - PC$$

where

CS_{NZ} = consumers' surplus associated with visits by New Zealanders;

NB_F = net benefits associated with visits by foreigners; and

PC = the opportunity cost of providing the services associated with the Park.

We have estimated that the consumers' surplus associated with the visits by New Zealanders (CS_{NZ}) over 1984 to be $2.2 million. From the national point of view this is an estimate of value, before accounting for any benefits derived from foreign visitors, and before any allowance is made for non-use benefits that might be associated with Mount Cook National Park. Estimating the net benefits associated with foreign visitors (NB_F) requires information that is not available from the survey of visitors to the Park. To determine NB_F we need an estimate of the portion of the inflow of foreign dollars attributable to a visit to the Park; from this we would deduct the portion of the national costs of a visit to New Zealand, by a foreigner, that are attributable to a visit to the Park. An estimate of the costs associated with a visit would include transportation, accommodation, and any congestion costs associated with foreign visitors. If the tourist industry is competitive and there is no subsidisation occurring, then we would expect NB_F to be positive. The Department of Lands and Survey spent $0.98 million on salaries and maintenance of the Park over the financial year ending March 1985. The opportunity cost of providing the services associated with the Park (PC) is $0.98 million plus the rental value of the land in its next best alternative use. Therefore, in 1984 we estimate the net benefits from use to be:

$$NB = \$2.2 \text{ million} + \$(>0) - 0.98 \text{ million} - \text{land rental}$$

Given the nature of the land, it seems most unlikely that its rental value would be more than $1.22 million a year. If this is true, then the current use of the land resource is superior to the next best alternative. Inclusion of non-use benefits would probably increase national benefits of Mount Cook National Park still further.

In this study we have estimated only the regional effects of visitor expenditures within the region. The results summarised in Table 8.2 derive their significance only from regional economic objectives, they should not be added to consumers' surplus. If future visitors behave in a similar way to 1984 visitors, then we could predict the regional effects of increased visits to the Park. For example, it would be possible to determine the output and labour requirements of local industry and thereby identify constraints to satisfying the demands of increased visitation.

8.3 Implications for Research

This study has identified several areas of research that would improve estimates of benefits or be useful to park management.

8.3.1 GRIT Method

The regional input-output coefficients produced using the GRIT procedure could be improved by the addition of superior data. Two areas are most likely to provide significant improvements.

- ▲ The choice of method for allocating final demands to households.

  In this study we were forced to use an arbitrary decision rule for the allocation of final demands. A business survey to find total sales of each industry to consumers within the region would avoid this necessity. a survey of this type would probably only be feasible in a small region because of the costs involved. The smaller the region however, the more identifiable are individual firms, reducing the degree of compliance for requests of this nature.

- ▲ The identification of numbers of people employed in small industries.

  The better identification of numbers of people employed in individual industries could greatly improve the accuracy of regional multipliers, and reduce their upward bias. If employment information, or alternatively local industrial output values, are known accurately a less aggregated regional input-output model may be developed. Obtaining this more detailed information may not prove difficult in isolated regions where individuals are well known to each other. Members of Twizel Development Incorporated were able to supply this information for Twizel township, and it is probable that other communities would be able to do likewise.

8.3.2 National Travel Cost Analysis

The estimates of consumers' surplus obtained in this section of the study could have been greatly improved if we had a better idea of the relative worth of the Park compared to other trip destinations. Trip indices which allocate value in proportion to time spent at destinations do not seem appropriate. Most people spend only a couple of hours in the Park, but many remark that it is the highlight of their trip. It may be possible to get visitors to rank, or score, their trip destinations according to importance, and adjust travel costs accordingly. At least this would give a clear indication of the direction of bias associated with the approach used here to allocate joint costs.

The value of travel time and the modes of transport chosen by visitors from different zones are closely related. This had implications for choice of the correct value of travel cost. We chose to assume that all visitors travelled by the same mode of transport. A better defined model of recreational travel would identify the minimum travel cost for each zone over the range of modes of transport.

A better description of the whole recreational trip would eliminate the downward bias on consumers' surplus caused by using minimum travel distances.

8.3.3 Worldwide Travel Cost Analysis

All comments regarding the application of the travel cost method to New Zealand also apply to the worldwide analysis. Mode of transport is limited to air for international travel, but a further dimension is added by the necessity of describing travel between the visitor's home and the international departure point. Where an on-site survey is conducted we recommend identifying visitor zone of origin independently to assess any bias introduced through differential response rates across zones.

The most pressing need to enable application of an international travel cost model is the definition and collection of a set of variables to describe tastes and; socio-economic, political, cultural and other variables influencing visitation to the site. If this cannot be done it may often be impossible to use the travel cost method to value sites for international visitors, as the cost of travel may have only a small influence on the decision to visit. If this can be done there remains a major challenge in designing a questionnaire which supplies all necessary details on the travel itinerary yet remains concise and easily answerable to allow an acceptable response.

8.3.4 Marginal Analysis

All estimates of economic benefit presented in this report are either total or average values, and not the marginal values necessary for a more insightful economic analysis. While we have shown that Mount Cook National Park, as it was in 1984, provided net benefits to New Zealand we are unable to answer questions such as: what is the optimal size of the Park; or, should the Department of Lands and Survey increase Park management spending?; or, what is the optimal level of commercial activity in the Park? To answer these questions it is necessary to know how aggregate demand is affected by adding an extra hectare to the Park, or employing an extra ranger, or spending extra money upgrading tracks and huts, or the likely congestion associated with increased commercial activity. Once the change in consumers' surplus attributable to these decisions is known then it may be compared to the opportunity cost of the necessary inputs to evaluate whether the change will increase net benefits produced by the Park.

The only means presently available for assessing marginal changes is the contingent valuation method. This technique suggests a proposed change to a resource, or its management, and elicits individual willingness to pay by various bidding mechanisms either to prevent or ensure the proposed change occurs (Just *et al.*, 1982). Contingent valuation has benefit in that it is able to identify gainers and losers, as well as the extent of their gains and losses, which is useful for management where decisions must be made on the extent of provision of various competing opportunities. Contingent valuation techniques allow the better understanding of many management effects which could be useful to park managers, including the range and quality of experiences offered. The latter is important in areas of concern such as management of congested facilities, or defining the standards of maintenance of foot tracks and huts. Development of a format for application of contingent valuation to park management issues is likely to provide major guidance in making decisions at the margin, and especially in cases of conflict in which one group's welfare must be traded-off for another's.

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APPENDIX A

MASTER SHEET

Date __/__/__

Weather ____

Name	Interviewer Sheet Nos	Questionnaire Numbers

To be filled out each day and held with the Interviewer Sheets for that day.

INTERVIEWER SHEET

Sheet Number

INTERVIEWER'S NAME ____________________

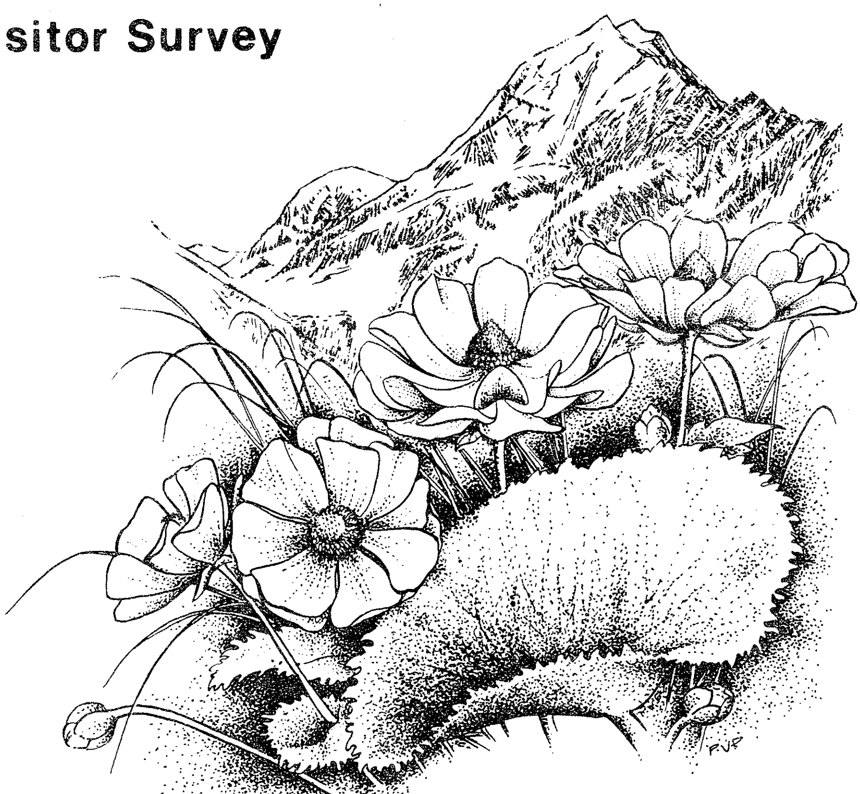
DATE ____________

Questionnaire number	Number in Vehicle		No. of Q's given to vehicle	Time	Type of Vehicle
	Adults	Children			

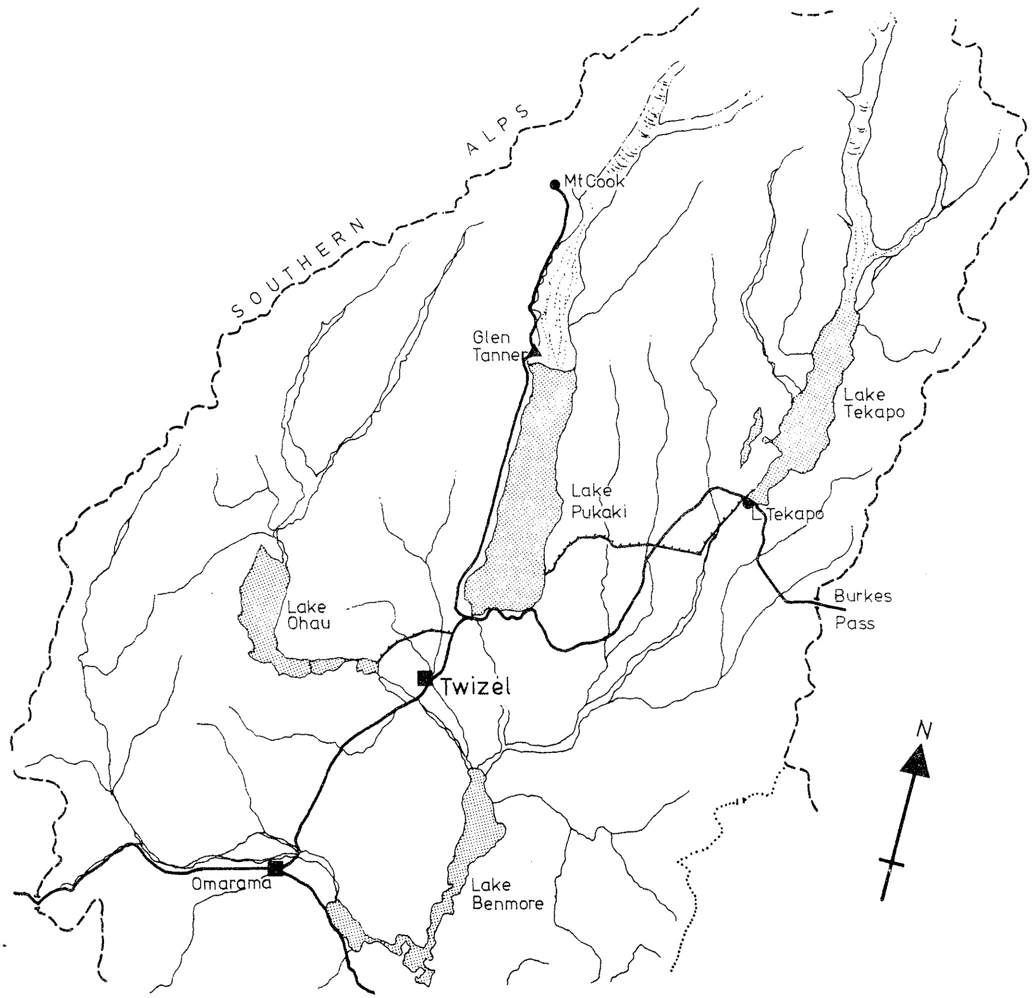
APPENDIX B

Mount Cook National Park

Visitor Survey



Map of the Region



Centre for Resource Management

University of Canterbury & Lincoln College, New Zealand

(Incorporating Tussock Grasslands & Mountain Lands Institute
& Joint Centre for Environmental Sciences)

University of Canterbury
Private Bag
Christchurch
Tel. 482-009

MOUNT COOK NATIONAL PARK

VISITOR SURVEY

Dear Visitor

We invite you to assist us by completing this questionnaire.

The objective of this study is to provide information that will assist with the management of New Zealand's system of National Parks. In the initial phase of this project we are surveying visitors to Mount Cook National Park.

Your help is essential for the success of this study. The information you provide will be treated with the utmost confidence.

To return this questionnaire please place it in one of the blue boxes which have been placed in the Village area. A map showing box locations is on the back of the questionnaire.

Thank you for your co-operation.

Geoff Kerr and Basil Sharp

Please address all correspondence to: University of Canterbury, Private Bag, Christchurch.

SECTION I : TRAVEL

The answers to these questions will describe your trip and why you have come to Mount Cook National Park.

1. How many people are you filling this questionnaire in for? TOTAL [ ]

   - number of people 15 years or older [ ]
   - number of people under 15 years [ ]

2. How are you travelling to and from Mount Cook National Park?

	TO	FROM
Private car		
Hire car		
Tour bus		
Scheduled bus		
Tour air		
Scheduled air		

   Other (please specify) ____________

3. Where is your home? TOWN ____________
   COUNTRY ____________

4. What was the main reason for your visit to Mount Cook National Park?

   ____

   ____

   ____

5. Is this your first trip to Mount Cook National Park? YES [ ] NO [ ]

6. Are you staying overnight in Mount Cook National Park? YES [ ] NO [ ]

7. If you are staying overnight in National Park, where are you staying and for how long?

	No. of nights
Hermitage Hotel	
Glencoe Lodge	
Chalet/Motels	
Camping in Park	
Park Huts	
Youth Hostel	
Club Base Hut	

   Other (please specify) ____________

8. If you are staying at Glentanner Park, how many visits will you make to Mount Cook National Park this trip? [ ]

9. Where did you spend last night before arriving at the Park? (nearest town) ____________________

10. Where will you spend your first night after leaving the Park? (nearest town) ____________________

11. NEW ZEALANDERS
How long is your trip (days away from home? ______________ DAYS

12. VISITORS FROM OVERSEAS
a. How long are you staying in New Zealand? ______________ DAYS

b. What countries are you visiting on your trip to and from New Zealand?

COUNTRY	NO. OF NIGHTS

13. ALL VISITORS TO MOUNT COOK NATIONAL PARK

What destinations are most important to you on your trip within New Zealand?
If you stay overnight please enter the number of nights.

DESTINATION	NO. OF NIGHTS

SECTION II : EXPENDITURES THIS TRIP

We would like to know how much money (to the nearest dollar) you have spent and expect to spend at <u>each</u> of the locations listed below. This will help us to identify the needs of different types of visitors to the region.

	OMARAMA	LAKE TEKAPO	TWIZEL/LAKE RUATANIWHA	GLENTANNER PARK	MOUNT COOK NATIONAL PARK
Accommodation/ campground fees					
Meals					
Other food and drink					

Gifts and souvenirs					
Petrol and vehicle costs					

Ski-plane/ scenic flight					
Helicophter flight					
Bus/4-wheel drive trip					
Guided climbing/ skiing/walking					
Rafting					

GEAR HIRE:

a. Climbing/ walking					
b. Skiing					
c. Motorcycle					
d. Horse					
e. Canoe					

OTHER					

SECTION III : PARK ACTIVITIES

Please tell us about your trip to Mount Cook National Park.

1. Was Park Headquarters easy to find? YES [ ] NO [ ]

2. Did you visit Mount Cook National Park Headquarters? YES [ ] NO [ ]

3. Did you do any of the fofllowing while you were in the Park? (please check)
   - Short walks around the Village [ ]
   - Kea Point Walk [ ]
   - Sealy Tarns Walk [ ]
   - Red Lakes Walk [ ]
   - Walk into Hooker Valley [ ]
   - Visit Tasman Valley (Ball Hut Road) [ ]
   - Participate in the Park Headquarters' Holiday Programme [ ]

4. Did any feature(s) of the Park: a. add particularly to the enjoyment of you visit?

   ____

   ____

   b. detract particularly from the enjoyment of your visit?

   ____

   ____

5. Do you have any comments to make about the facililties at Mount Cook National Park?

   ____

   ____

   ____

   ____

✱ Please place your completed questionnaire in one of the blue boxes located at the sites shown below.